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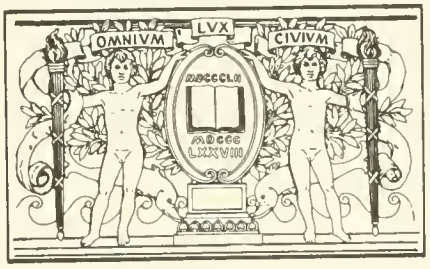

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FINAL ENVIRONMENTAL IMPACT REPORT FOR THE MEDICAL AREA TOTAL ENERGY PLANT BOSTON, MASSACHUSETTS

I

ERT Document P-1241

September 29, 1975

prepared for
BOSTON REDEVELOPMENT AUTHORITY AND
DEPARTMENT OF ENVIRONMENTAL QUALITY ENGINEERING
BOSTON, MASSACHUSETTS

ENVIRONMENTAL RESEARCH & TECHNOLOGY, INC.
696 VIRGINIA ROAD CONCORD MASSACHUSETTS 01742 (617) 369-8910

FINAL ENVIRONMENTAL IMPACT REPORT FOR THE MEDICAL AREA TOTAL ENERGY PLANT BOSTON, MASSACHUSETTS

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This Final Environmental Impact Report consists of additions and insertions to the Draft Environmental Impact Report that was filed with the Executive Office of Environmental Affairs on April 30, 1975. These additions and insertions include a section entitled, Changes to the Project; errata sheets for the Draft EIR; Section 8, Written Comments By Reviewing Agencies and the Public and Responses by the Applicant and/or Authority; and Appendix I, Steam and Electricity Demands and Consumption and Associated Emissions for the Year 1990.

Boston Redevelopment Authority

Robert T. Kenney / Director

City Hall
1 City Hall Square
Boston, Massachusetts 02201
Telephone (617) 722-4300

SEP 29 1975

Secretary Evelyn Murphy
Executive Office of Environmental Affairs
100 Cambridge Street
Boston, Massachusetts, 02202

Attention: Mr. William Hicks

RE: Final Environmental Impact Report
Medical Area Total Energy Plant
EOEA No. 01540

Dear Secretary Murphy:

On behalf of the Department of Environmental Quality Engineering and the Boston Redevelopment Authority, I am forwarding to you two copies of the Final Environmental Impact Report prepared in connection with the proposed construction of a total energy plant at Brookline Avenue and Francis Street, Boston, Massachusetts.

This report is being submitted pursuant to Massachusetts General Laws, Chapter 30, Section 62, and in accordance with the Authority's rules and regulations governing the protection of the environment and in accordance with any other applicable rules and regulations concerning the protection of the environment. By separate cover, copies of this report have been submitted to the Office of the Attorney General and to the Metropolitan Area Planning Council. In addition, ten copies have been submitted to the State Clearinghouse.

A Notice of Intent was filed with your office on February 11, 1975, and received the designation EOEA No. 01540. The Draft Report was filed on April 30, 1975.

Sincerely,

Robert T. Kenney
Director

RTK/bap

DAVID STANDLEY
COMMISSIONER

The Commonwealth of Massachusetts

Executive Office of Environmental Affairs
Department of Environmental Quality Engineering
100 Cambridge Street
Boston, Massachusetts 02202

September 29, 1975

Secretary Evelyn Murphy
Executive Office of Environmental
Affairs
State Office Building
100 Cambridge Street
Boston, Massachusetts 02202

Attention: MEPA Unit

Re: Boston - Environmental Protection
Medical Area Total Energy Plant
E.O.E.A. No. 01540
Final Environmental Impact Report

Dear Secretary Murphy:

The Department of Environmental Quality Engineering joins the Boston Redevelopment Authority in submitting the Final Environmental Impact Report for the Medical Area Total Energy Plant - September 29, 1975.

Further, this office is of the opinion that the attached letters dated September 12, 1975 and September 29, 1975 which deal with air quality should be made available to all persons reviewing the report in order to facilitate their proper evaluation of it.

Accordingly, these letters are hereby made part of the report to be circulated with it.

Very truly yours,

David Standley

Commissioner

Enclosures
Letter of September 12, 1975
Letter of September 29, 1975

C- Robert T. Kenney, Director
Boston Redevelopment Authority
1 City Hall Square
Boston, Massachusetts 02201

S/Edep

DAVID STANDLEY
COMMISSIONER

The Commonwealth of Massachusetts
Executive Office of Environmental Affairs
Department of Environmental Quality Engineering
100 Cambridge Street
Boston, Massachusetts 02202

September 29, 1975

Robert T. Kenney, Director
Boston Redevelopment Authority
City Hall - Room 900
1 City Hall Square
Boston, Massachusetts 02201

RE: "Final Environmental Impact Report for the Medical Area Total Energy Plant - Boston Massachusetts - September 29, 1975"

Dear Mr. Kenney:

In a letter of September 12, 1975 the Department informed you and, by copy, other interested parties, of several issues which it believed should be addressed in a final Environmental Impact Report (EIR) on the proposed MASCO Total Energy Plant.

Subsequently, meetings between Department staff and an Environmental Research and Technology, Inc. representative were held to discuss these issues further.

The final EIR, dated September 29, 1975, has been submitted to the Department for review prior to publication.

The Department now believes that each of the issues raised in the aforementioned letter has been addressed; however, the report could still be criticized. In particular, a person not familiar with the history of the report could have difficulty comparing the impact of alternatives on air quality since two sets of fuel usage assumptions are used in two different portions of the report. The reasons for this are explained in Chapter 8, together with a summary of air quality and other impacts assuming a fuel consumption of 37,000,000 gallons annually rather than 27,000,000 gallons annually. Ideally, this section should be cross-referenced with Chapter 4, which deals with air quality impacts. Moreover, the issue of non-attainment of the National Ambient Air Quality Standards for Total Suspended Particulate in the Metropolitan Boston Air Pollution Control District is mentioned only briefly in Chapter 8.

The information provided, is believed sufficient to identify these issues upon complete and careful review of the entire document.

It is requested, however, that this letter, and the aforementioned letter of September 12, 1975 be appended to the report and become a part thereof to alert reviewers to these areas of concern.

Very truly yours,

David Standley

Commissioner

C - Secretary Murphy
C - William F. Hicks
C - Mr. Mertens, BRA
C - MASCO
C - ERT, Mr. Pincus
C - Ray Rodriguez

S/Ewfcam

The Commonwealth of Massachusetts
Department of Environmental Quality Engineering
~~Department of Public Health~~
600 Washington Street
Boston 02111

David Standley
~~WILLIAM H. DICKHOFF, M.D.~~
COMMISSIONER

September 12, 1975

Boston Redevelopment Authority
City Hall - Room 900
1 City Hall Square
Boston, Massachusetts 02201

Re: MASCO Proposal EIR

Dear Mr. Kenney:

As you know, the Department is responsible jointly with the BRA, for submitting an Environmental Impact Report (EIR) to the Executive office of Environmental Affairs (EOEA) on the proposed Medical Area Total Energy Plant, commonly referred to as the MASCO Project.

Apparently MASCO is now very anxious to have a final EIR submitted and published in the EOEA Environmental Monitor.

I believe it would be unacceptable for our agencies to submit the EIR in its' present form as prepared for MASCO by Environmental Research and Technology.

The principal problem remaining with the report is that it fails to evaluate and compare adequately the environmental impacts of a MASCO Total Energy Plant with several alternatives that appear to be available.

Boston Edison Company has vigorously opposed the project, submitted extensive comments on the draft EIR, and claims it has offered three alternatives to a total services MASCO plant.

The Department's Bureau of Air Quality Control, however, has been unable to compare the air quality impacts of these alternatives properly because of a significant disagreement between Edison and the MASCO consultant on the projected fuel-use of the MASCO project vs. Edison alternatives.

Edison claims its fuel-use estimates are based in large part on actual meter-readings. In this regard, we understand that the BRA has engaged a consultant to perform an independent study of the fuel-use requirements of the MASCO project, and that the results of this study will be available shortly.

To resolve this and other problems associated with properly evaluating the alternatives available, I suggest the following course of action:

First, the difference in fuel use estimates by MASCO and Edison must be reconciled. Copies of the BRA consultants' report should be transmitted to this Department, MASCO, ERT and Edison for review, and to allow an explanation of the reasons for the differences.

Second, this Department believes that, since each of the Edison alternative appears technically practicable, they should be evaluated as alternatives for the purpose of an EIR. It would certainly appear that generation of electric power at sites remote from the Boston Core Area would have less continuing impact on core Boston Air Quality, than the present MASCO proposal. In this regard, Department staff at a recent meeting with Edison requested that Edison provide a detailed analysis of how emissions from generating electricity to serve MASCO needs would be apportioned throughout the Electric Grid Network. Edison agreed to provide this analysis by Monday, September 15, 1975.

A comparison of the air quality impact, and to a reasonable extent, the other environmental impacts of each alternative, using comparable assumptions, methods and format, must be prepared.

Finally, the EIR should include a statement by this Department clarifying the fact that the Metropolitan Boston Air Pollution Control District is a non-attainment region for Total Suspended Particulate (TSP). A plan to attain both primary and secondary Ambient Air Quality Standards for TSP is now being prepared by the Department for submittal to the U.S. Environmental Protection Agency. Accordingly, we may be unable to justify approval of plans and specifications for MASCO, or Edison alternatives, unless the best particulate emission control technology obtainable is applied to the steam generating, power generating and incinerator facilities involved. This may, for example, require revision of the present MASCO plans to include electrostatic precipitators rather than the cyclone collectors presently proposed. A taller stack may be considered necessary. These design approval decisions cannot be made by the Department until final plans and specifications are submitted for review, but should be considered at the outset by the design engineers.

Our staff is progressing satisfactorily in addressing the other EIR comments with the MASCO consultant. Upon resolution of the central issue of "alternatives" it should be possible to prepare an acceptable final EIR in the near future.

If you have any questions regarding this recommendation, please let me know.

Very truly yours,

Commissioner

C- Secretary Murphy,
William F. Hicks
C- Mr. Mertens, BRA
C- MASCO
C- ERT
C- Ray Rodriguez

SUMMARY INFORMATION SHEET

Name of Project:	Medical Area Total Energy Plant
Name of Agencies:	Boston Redevelopment Authority and Department of Environmental Quality Engineering
Date Submitted to EOEA:	September 29, 1975
Type of Report:	FINAL ENVIRONMENTAL IMPACT REPORT
Brief Description of Project:	Total energy plant to provide medical area institutions with steam, electricity, chilled water and incinerator service.

Major Benefits, Costs and Environmental Impact of the Project

Major benefits include lower cost of a reliable source of utilities; incorporation of refuse incineration; termination of the existing power plant. Major costs include the loss of 17 buildings that have a potential for providing 97 dwelling units and two buildings used for institutional purposes. Construction phase impacts of the project include changes in air quality, noise levels, aesthetics and truck traffic which are typically associated with large scale construction projects. Operation phase impacts include sources of air contaminants and noise which have only minor impacts on air quality and noise levels, and when combined with the termination of the existing plant may improve air quality and noise levels. The most prominent physical aspect of the project will be the smoke stack 315 feet in height.

Summary of Measures to Avoid or Minimize Adverse Environmental Impacts

During construction and operation, all state and federal laws that regulate construction practices and protect the environment will be followed. During construction practices such as wetting surfaces, covering loads, providing remote parking areas, installing security fencing and guards and careful scheduling of delivery of materials will help minimize impacts. During operation use of particulate collectors, low sulfur oil, a tall stack passing exhaust gases from one combustion process into the combustion air of another and the counter-flow cooling tower will help minimize impacts.

CHANGES TO THE PROJECT

The design of the total energy plant and analysis of impacts has been an ongoing process since the Draft EIR was published on April 30, 1975. Exterior physical changes include elimination of the top floor of the MASCO offices that face Brookline Avenue and extension of the stack from 300 feet to 315 feet. The office floor has been removed because the space is not necessary and the stack has been extended to ensure that the plume from the stack will not be caught in the wake or cavity of nearby buildings. Neither of these changes significantly affects the extent of impacts presented in the Draft EIR. The 15-foot stack extension will increase the visual impact to a small degree but the extra height should not be clearly discernible. It will also allow for increased dispersion of emissions.

Another change in the project includes estimation of a fuel use in the year 1990 that could occur using the equipment proposed for installation in 1978. This fuel use is higher than that presented in the Draft EIR.

This section of the final report compares the energy needs of the institutions on which the new fuel use is based to the needs presented in the Draft EIR and explains how impacts of air quality, truck traffic, and environmental impacts of the alternatives change.

Fuel Use and Steam and Electricity Generation

In order to make certain that the impacts of the project are conservatively high, the fuel use of the plant has been projected for the year 1990. This has been done since oil use directly affects the number of trucks that serve the project, the air contaminant emissions and the resulting air quality.

The engineers, Paul L. Geiringer and Associates (PLGA), have recently resurveyed the individual cooperators as to present and future uses of energy and have examined the latest steam records from the existing power plant in order to reevaluate energy demands and consumption. This work has been done to update the work they had done in 1973, which indicated a fuel use of 21,453,400 gallons per year in 1975. Based on the recent results, fuel use could be 27,076,680 gallons in the

year 1990. This oil will be used to supply energy to all the MASCO members, including the Joslin Diabetes Center, Sidney Farber Cancer Center's Dana Building, the Seeley G. Mudd Biochemical Laboratory and plant usages and distribution losses. It also reflects steam to be supplied to the Mission Park Housing Development.

The following list compares the fuel uses on which the Final EIR and Draft EIR are based and the associated steam and electricity generation.

	Final EIR (1990)	Draft EIR (1975)
Fuel Use, gallons/yr	27,076,680	21,453,400
Steam Generation, lbs/yr	$1,909,007 \times 10^3$	$1,660,000 \times 10^3$
Electricity Kwh/yr	204,736,000	172,983,000

In the Draft EIR the steam generation of $1,660,000 \times 10^3$ lb/year was used to calculate fuel use; however, Tables 5.2.1-1 and 5.2.1-2 on page 5-32 inadvertently presented steam needs based on an earlier plant design that used all steam driven chillers and thus showed a higher steam use. Those tables have been revised to reflect the actual plant design that relies on motor driven chillers.

The basis for the steam and electricity generation used in the Final EIR are presented in Appendix I of this report and includes a breakdown of needs for each institution served by the energy plant and the use by the energy plant itself.

As part of the preparation of the Final Environmental Impact Report the firm of Parsons Brinckerhoff Quade & Douglas under contract with the Boston Redevelopment Authority reviewed the engineering basis for the fuel use figures presented in this report. Upon review of that report the Boston Redevelopment Authority has prepared a letter asking that further clarifications be addressed in this report. That letter and response to it are contained in Section 8.

Truck Traffic during Operation

Delivery of 27,076,680 gallons of No. 6 oil per year will require 4,512 trucks with capacities of 6,000 to 6,500 gallons. In addition to these trucks, it is estimated that 16 trucks per year will deliver No. 2

and lube oils. One ash removal truck with 30 cubic yard capacity will be required per week. This is an annual truck volume of 4,580. It has been estimated that 480 trucks will be required in January and 290 in August. Oil delivery trucks to the energy plant were presented in the Draft EIR as about 3,600 per year.

The oil trucks will travel down Brookline Avenue to Longwood, turn left and then right onto Binney to the total energy plant. Trucks leaving the energy plant will turn right onto Francis and then right onto Brookline Avenue. The design of the exit allows the trucks to turn right onto Francis without crossing the middle of the road and prohibits a left turn onto Francis.

As presented in this report, the trucks will create a noise impact as they travel their route. This impact has not been judged significant especially in comparison to traffic that exists in the medical area. On a winter day, 12 to 20 trucks may service the energy plant. This traffic and its related noise impact is small in comparison to existing traffic which reaches a peak of 600 vehicles per hour along Francis Street, 1,700 per hour on Brookline Avenue and 300 per hour on Binney Street.

These trucks are not major contributors of carbon monoxide concentrations since the carbon monoxide emission rate of a heavy diesel truck is less than that of individual cars now on the road.

The project, as a side benefit, will eliminate trash trucks in the area. These trash trucks are sources of noise since they must maneuver in tight areas and load and compact trash while idling. The necessity of having exterior trash bins that are a health and aesthetic problem will also be eliminated by this project. The Draft EIR estimated that 5,200 trash trucks would be eliminated based on costs and services provided by disposal contractors.

Air Quality

The oil use for 1990 presented in this Final EIR is about 26% greater than the oil use on which the Draft EIR was based. This does not, however, increase all of the hourly and annual emissions by 26%. The recent study of energy loads indicated a different operating pattern

of the diesels and the steam boilers which results in the diesels burning more fuel and emitting more nitrogen oxides. The emissions presented in the Draft EIR and those based on the updated energy loads of the total energy plant are listed below for comparison.

	Emissions in 1975		Emissions in 1990		Percent Change	
Annual	Hourly (lb/hr)	Annual (lb/yr)	Hourly (lb/hr)	Annual (lb/yr)	Hourly (%)	Annual (%)
SO_2	525	1,685,700	580	2,124,390	10	26
Particulates	54	193,260	60	234,780	11	21
NO_2	876	3,525,110	1,172	5,630,460	34	60

The emissions in 1990 replace those listed on Page 5-45 of this report.

The fuel uses for the diesels and boilers from which annual emissions were calculated are as follows:

	1990	1975
Fuel Used in Diesels	11,784,340 gal	6,894,000 gal
Fuel Used in Boilers	15,292,340 gal	14,559,400 gal
	27,076,680 gal	21,453,400 gal

The plant operating conditions which result in the peak hourly emissions are as follows:

Contaminant	Operating Parameters Resulting in Peak Emissions
SO_2 and Particulates	608,000 lb of steam/hr 25,700 Kw generated by the diesels 10,300 Kw generated by the back pressure turbine incineration of 14 tons of trash/day
NO_2	256,000 lb of steam/hr 39,830 Kw generated by the diesels 4,750 Kw generated by the back pressure turbine incineration of 14 tons of trash/day

It should be noticed that peak NO_2 emissions do not occur under the same conditions that produce peak SO_2 and particulate emissions.

The calculations for the annual and peak hourly emissions are presented in Appendix I of this report.

The emissions from the diesels and boilers has been presented to show the emissions from those types of equipment. However, these emissions are not additive because the period of peak diesel and boiler emissions do not occur at the same time.

Emissions from the diesels are as follows:

SO_2	203 lb/hr	919,179 lb/yr
NO_x calculated as NO_2	1,094 lb/hr	4,955,315 lb/yr
Particulates	19 lb/hr	85,436 lb/yr

These are based on an electrical generation by the diesels of about 39,800 Kw and an annual fuel usage in the diesels of 11,784,340 gallons. These emissions replace those presented on page 5-41.

Emissions from the boilers are as follows:

SO_2	447 lb/hr	1,192,800 lb/yr
NO_x calculated as NO_2	250 lb/hr	665,215 lb/yr
Particulates	42 lb/hr	110,869 lb/yr

These are based on a steam load of 608,000 lb/hr and an annual fuel useage in the boilers of 15,292,340 gallons. These emissions replace those presented on page 5-43.

The increased fuel use for 1990 on which the Final EIR is based will change the concentrations presented in the Draft EIR by the percentage change of emissions presented above. Sulfur dioxide and NO_2 concentrations presented on page 5-48 and particulate concentrations on page 5-50 are revised as follows:

	Calculated Contributions to Ground Level Concentrations		Federal and Massachusetts Standards
	Peak Load	50% of Peak Load	
SO_2			
3-hr av.	0.018 ppm	0.012 ppm	0.5 ppm
24-hr av.	0.007 ppm	0.006 ppm	0.14 ppm
annual av.	0.0005 ppm	0.0005 ppm	0.03 ppm
NO_2			
annual av.	0.0013 ppm	0.0013 ppm	0.05 ppm

	Calculated Contributions to Ground Level Concentrations		Federal and Massachusetts Standards
	Peak Load	50% of Peak Load	
Particulates			
24-hr av.	1.89 $\mu g/m^3$	1.4 $\mu g/m^3$	150 $\mu g/m^3$
annual av.	0.13 $\mu g/m^3$	0.11 $\mu g/m^3$	60 $\mu g/m^3$

The concentration values shown in the contours of SO_2, NO_2 and particulates in Figures 5.2.2-1, 5.2.2-2 and 5.2.2-3 should be increased by 26%, 60% and 21%, respectively.

The concentrations of contaminants contributed to Parker Hill presented on page 5-53 should be revised as follows to reflect the increased emissions.

	Averaging Period	Concentration Contributed	Air Quality Standard
SO_2	3 hr	0.029 ppm	0.50 ppm
	24 hr	0.011 ppm	0.14 ppm
	annual	0.00025 ppm	0.03 ppm
Particulates	24 hr	2.78 $\mu g/m^3$	150 $\mu g/m^3$
	annual	0.09 $\mu g/m^3$	60 $\mu g/m^3$
NO_2	annual	0.00048 ppm	0.05 ppm

The maximum concentrations at important receptors presented in Table 5.2.2-3 on page 5-55 are also affected by the increased fuel; 3-hr and 24-hr concentrations of SO_2 should be increased by 10% and the annual concentrations by 26%; annual NO_2 concentrations should be increased by 60%; 24-hr concentrations of particulates should be increased by 11% and annual concentrations by 21%.

It should be recognized that the above increases in concentrations do not reflect the mitigating effects of the 15-foot stack extension and the increased volume of flue gases associated with the higher fuel use which will increase plume rise and allow for better dispersion of the emissions.

Environmental Impacts of Alternatives

In order to reflect the proposed project's fuel use in 1990 and Boston Edison's stated generation of 30% of its electricity from nuclear fuel, the environmental impacts of the alternatives which rely on Boston Edison for electricity and steam have been revised.

One alternative to the proposed project is to have Boston Edison provide the electricity and have the institutions provide only steam and chilled water. If 30% of the electricity were provided by its nuclear plant, Edison would have to burn 10,242,600 gallons of fuel oil to provide the rest of the electricity. The generation of steam and chilled water, would require approximately 18,229,200 gallons of fuel. Under this alternative a total of 28,471,800 gallons of fuel oil would have to be burned to supply the needs of the institutions compared to the 27,076,680 gallons required by the proposed plant. The resulting quantity of contaminants emitted annually in the Boston area are shown below.

	Proposed Project	Alternative of Boston Edison Supplying Electricity
SO_2	2,124,390 lb/yr	2,233,210 lb/yr
NO_2	5,630,460 lb/yr	1,248,450 lb/yr
Particulates	234,780 lb/yr	244,890 lb/yr

These emissions include continued incineration at the proposed site and are based on all combustion equipment meeting the same emission standards as the proposed project. The emissions replace those presented on page 7-13 of this report.

By removing the electrical generation from the proposed site the lower amount of fuel will reduce the annual number of trucks delivering No. 6 fuel oil from 4,512 to about 3,040.

If Boston Edison were to supply both steam and electricity by constructing and operating a steam plant on Station Street and a step down transformer station on Colburn Street, Boston Edison would have to burn approximately 19,140,650 gallons of oil to generate steam and 10,242,600 gallons of oil to generate electricity. These fuel figures include steam distribution losses of 5% in the distribution system from Station Street to the medical area and the 30% generation of electricity by

nuclear fuel. This results in a use of oil of about 29,383,250 gallons as compared to the proposed project's 27,076,600 gallons.

The resulting quantity of contaminants emitted annually in the Boston area are shown below.

	Proposed Project	Alternative of Boston Edison Supplying Steam and Electricity
SO_2	2,124,390 lb/yr	2,291,890 lb/yr
NO_2	5,630,460 lb/yr	1,278,170 lb/yr
Particulates	234,780 lb/yr	213,030 lb/yr

The emissions of the alternative do not include emissions from incineration at the proposed site since incineration would not be feasible without the ability to use the heat produced during incineration. The emissions from the alternative are also based on all combustion equipment meeting the same emission standards as the proposed project. These emissions replace those presented on page 7-16 of this report.

This alternative would remove oil delivery trucks from the medical area but would not permit elimination of the existing method of trash handling and removal.

DRAFT ENVIRONMENTAL IMPACT REPORT FOR THE MEDICAL AREA TOTAL ENERGY PLANT BOSTON, MASSACHUSETTS

ERT Document P-1241

April 30, 1975

prepared for
BOSTON REDEVELOPMENT AUTHORITY AND
DEPARTMENT OF PUBLIC HEALTH
BOSTON, MASSACHUSETTS

ENVIRONMENTAL RESEARCH & TECHNOLOGY, INC.
696 VIRGINIA ROAD CONCORD MASSACHUSETTS 01742 (617) 369-8910

SUMMARY INFORMATION SHEET

Name of Project:	Medical Area Total Energy Plant
Name of Agency:	Boston Redevelopment Authority Department of Public Health
Date Submitted to EOEA:	April 30, 1975
Type of Report:	DRAFT ENVIRONMENTAL IMPACT REPORT
Brief Description of Project:	Total energy plant to provide medical area institutions with steam, electricity, chilled water and incinerator service.

Major Benefits, Costs and Environmental Impact of the Project

Major benefits include lower cost of a reliable source of utilities; incorporation of refuse incineration; termination of the existing power plant. Major costs include the loss of 17 buildings that have a potential for providing 97 dwelling units and two buildings used for institutional purposes. Construction phase impacts of the project include changes in air quality, noise levels, aesthetics and truck traffic which are typically associated with large scale construction projects. Operation phase impacts include sources of air contaminants and noise which have only minor impacts on air quality and noise levels, and when combined with the termination of the existing plant may improve air quality and noise levels. The most prominent physical aspect of the project will be the smoke stack 300 feet in height.

Summary of Measures to Avoid or Minimize Adverse Environmental Impacts

During construction and operation, all state and federal laws that regulate construction practices and protect the environment will be followed. During construction practices such as wetting surfaces, covering loads, providing remote parking areas, installing security fencing and guards and careful scheduling of delivery of materials will help minimize impacts. During operation use of particulate collectors, low sulfur oil, a tall stack, passing exhaust gases from one combustion process into the combustion air of another and the counterflow cooling tower will help minimize impacts.

ERRATA FOR THE DRAFT EIR

Page	
V	APPENDIX G MEMORANDUM OF UNDERSTANDING By and Between ROXBURY TENANTS OF HARVARD ASSOCIATION, INC. and PRESIDENT AND FELLOWS OF HARVARD COLLEGE
V	APPENDIX H LETTERS
33	First paragraph line should read "...be about $1,870,000 ..." instead of $1,980,000
3-19	In Figure 3.5-5 the dust collectors for the incinerators will follow the heat recovery boilers
4-6	Table 4.1-3 should have subheadings which indicate that the sampling station for the left portion of the table is South Bay in Boston and Central Sq. E. Boston sampling station is associated with the right portion of the table.
4-21	In Table 4.3-1 units for Total Coliforms should be "(#/100ml)"
4-25	Last line of the table should read "Total Coliforms (#/100ml)"
4-51	Second paragraph second line should read, "The 3dB difference ..."
5-31	First paragraph, sixth line should read "Peak Demand including Use in the Energy Plant and Distribution Losses" instead of Peak Demand and "Annual Consumption of Member Institutions" instead of Annual Consumption
5-31	First paragraph, line 9, the number 390,200,000 should be changed to 93,000,000.
5-31	First paragraph, line 10, should read "Annual consumption ... will be about 1,660,000,000 lb/year".
5-32	Tables 5.2.1-1 and 5.2.1-2 should be replaced by the two tables presented with this errata sheet
5-35	Line 5 should read "... the annual water use would be 72,000,000 gal/yr."

5-35 Last line of the first paragraph should read "... consumption will thus be about 96,884,000 gal/yr."

5-38 Particulate regulations for diesel driven generators should read "0.05 lb/10^6 Btu"

5-52 Particulate concentrations are in units of $\mu g/m^3$

5-54 The elevation of the Children's Hospital Research Building is 275 ft instead of 215 ft.

5-63 Second paragraph line 8 should read "... cooling tower makeup, ..."

7-4 The notation indicating the site of the Station Street Steam Station should read "Site of the Station Street Steam Station"

7-11 Second paragraph second line should read "... approximately $1,873,356."

7-12 At the end of Table 7.3-2 net change in cost of utilities if electricity is purchased should be "$1,873,356."

7-29 Title of Figure 7.5-2 should read "Brookline Avenue Elevation ..."

7-27 Title of Figure 7.5-1 should read "... Refurbishing the Row Houses"

5-60 First paragraph, line 7, the number 2,000 should be changed to 1800.

4-110 Title of photograph 3 should read "... Samaritan ..." instead of Semaritan.

TABLE 5.2.1-1

MONTHLY STEAM CONSUMPTION FOR SPACE HEATING, PROCESS AND AIR CONDITIONING

Steam Consumption (10^3 lbs)	January	February	March	April	May	June	July	August	September	October	November	December
Space, Process, Absorption Air Cond.*	193,000	182,000	154,000	115,000	77,000	62,000	65,000	60,000	66,000	89,000	131,000	178,000
Steam Dist. Loss 10% x line 1 x10% Central Plant Use is Plant Steam Output	233,530	220,220	186,340	139,150	93,170	75,020	78,650	72,600	79,860	107,690	158,510	215,380

Total annual steam generation is 1,660,120 x 10^3 lbs

TABLE 5.2.1-2

PEAK HOURLY STEAM DEMAND EXPECTED EACH MONTH(1)

Summary of Peak Demands (lbs/hr)	January	February	March	April	May	June	July	August	September	October	November	December
Space and Process	559,000	559,000	446,000	371,000	292,000	218,000	179,000	179,000	218,000	331,000	407,000	521,000
Absorption Air Cond.				16,000	35,000	54,000	62,000	54,000	43,000	25,000	6,000	
Total	559,000	559,000	446,000	387,000	327,000	272,000	241,000	233,000	261,000	356,000	413,000	521,000
Dist. & Plant Loss	118,000	118,000	94,000	81,000	69,000	57,000	51,000	49,000	55,000	75,000	87,000	110,000
Boiler Peak Output	677,000	677,000	540,000	468,000	396,000	329,000	292,000	282,000	316,000	363,000	500,000	631,000

*Steam for use in steam turbine driven chiller is negligible.

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1. INTRODUCTION

This report has been prepared on behalf of the Boston Redevelopment Authority and the Department of Public Health in accordance with the Massachusetts Environmental Policy Act. Chapter 30, Sections 61 and 62 of the General Laws of the Commonwealth of Massachusetts requires agencies of the commonwealth to review and evaluate all of their activities, to determine the impact on the natural environment of such activities and to use "all practicable means and measures to minimize damage to the environment".

These agencies are involved in the project presented in this report since the Boston Redevelopment Authority must act on an application from a corporation formed under Chapter 121A of the General Laws to own the proposed project and the Department of Public Health, Bureau of Air Quality Control, must act on a permit to construct a source of air pollution. This report has been prepared by Environmental Research and Technology, Inc., as consultants for the agencies and will be published on April 30, 1975.

The purpose of this report is to describe the proposed total energy plant, its impacts and alternatives.

The project and its impacts are summarized in Section 2. Details of engineering design are discussed in Section 3. Section 4 presents an in-depth description of the environment of the site and surrounding area. This serves as a basis for the analyses of environmental impacts during construction and operation which appear in Section 5. In order to be thorough more information on the existing environment has been included than is necessary for the type and location of the proposed project.

Section 6 summarizes those design and operational features that will minimize environmental damage, possible interactions with other projects, unavoidable adverse impacts and other measures that could further reduce environmental impact. This section provides an overall view of the environmental controls and major aspects of the project.

Alternatives to the project are described in Section 7. The environmental impacts of the alternatives are presented and the reasons that these alternatives were not selected are explained. This discussion

of alternatives follows the description and impacts of the project so that the reader will have a background with which to evaluate the alternatives.

Section 8 will be used to incorporate in the Final Environmental Impact Report any comments or questions from regulatory agencies or the public that this Draft Report may generate.

1.1 Environmental Assessment Form

Boston Redevelopment Authority

Robert T. Kenney / Director

City Hall
1 City Hall Square
Boston, Massachusetts 02201
Telephone (617) 722-4300

FEB 11 19[illegible]

Secretary Evelyn Murphy
Executive Office of Environmental Affairs
18 Tremont Street
Boston, MA 02108

RE: MASCO Total Energy Plant

Dear Secretary Murphy:

Attached please find an Environmental Assessment Form for the above-referenced project indicating the decision to file a standard environmental impact report.

The firm of Environmental Research and Technology, Inc. of Concord, Massachusetts, has been engaged as consultant to prepare the report. Pursuant to the Authority's environmental Rules and Regulations, we hereby request your approval of ERT to prepare the Environmental Impact Report. An EOEA Consultant Form, indicating the qualifications and experience of this firm, previously has been filed with your office.

Sincerely,

Robert T. Kenney
Director

Enclosure

Boston Redevelopment Authority

Robert T. Kenney / Director

City Hall
1 City Hall Square
Boston, Massachusetts 02201
Telephone (617) 722-4300

February 25, 1975

Secretary Evelyn Murphy
Executive Office of Environmental Affairs
18 Tremont Street
Boston, MA 02108

Re: MASCO Total Energy Plant E.I.R.

Dear Secretary Murphy:

On February 11, 1975, the Authority filed with your office an Evironmental Assessment Form for the above-referenced project indicating the decision to file a standard environmental impact report. Subsequently, the Department of Public Health, which also must approve plans for the construction of this facility, has agreed to participate on the preparation and submission of the impact report, with the Boston Redevelopment Authority designated as lead agency. Therefore, by this letter, we wish to amend the Environmental Assessment Form previously filed.

Sincerely,

Robert T. Kenney
Director

cc: Mertens
Berlandi
Baker
Fischman
Lonergan
John Goodrich (ERT)
David Elowitz (MASCO)
Steve Lindsey, Esq.

APPENDIX A

ENVIRONMENTAL ASSESSMENT FORM

This form is provided to assist you in determining whether a proposed project could cause significant environmental damage and thus require an environmental impact report.

EXECUTIVE OFFICE _____ DEPARTMENT _____

DIVISION _____ OTHER Boston Redevelopment Authority

PROJECT IDENTIFICATION Medical Area Service Corporation Total Energy Plant

PREDICTED DATES: Commencement 1975 Completion 1977-1978

PROJECTED COST 45,000;000

I. Background Information

1. Give a brief description of the proposed projects(s), and describe how your agency is involved in the project.

A total energy power plant is proposed to be constructed through the vehicle of a chapter 121 A corporation on a parcel of land owned in part by the President and Fellows of Harvard College, generally bounded as described in paragraph 2 below, which would be net-leased to and operated by the Medical Area Service Corporation to provide medical area institutions with a reliable and economical supply of steam, electricity and chilled water and incineration of solid waste. The installed facility will be a combination of fossil fuel burning combustion and mechanical equipment with the following operating capacities: steam 900,000 lb/hr, electricity 51,892 kw, chilled water 15,000 tons and solid waste incineration 20 ton/day.

The Boston Redevelopment Authority must grant approval of the Chapter 121 A application filed by the developer of the project.

2. Describe the geographical area or areas which will be affected by the project(s), including distinguishing natural and man-made characteristics, and a brief description of the present use of the area or areas.

The proposed project will be situated on the block bounded by Peabody, Binney and Francis Streets and Brookline Avenue. This is north of the intersection of Brookline Avenue and the Riverway. The site is now occupied by residential units, the majority of which are vacant, and parts of the Children's Hospital.

II. Assessment of Environmental Damage

Answer the following questions by placing a check in the appropriate space; consider both short and long term damage. Wherever "No" is checked, indicate on the lines below the question why there will be no significant damage.

	Short Term		Long Term	
	Yes	No	Yes	No
1. Could the project(s) affect the use of a recreational area or area of important aesthetic value?	___	X	___	X

No activities of the project will extend to recreational areas and there are no areas of important aesthetic value.

2. Are any of the natural or man-made features in affected area(s) unique; that is, not found in other parts of the Commonwealth or nation?	___	X	___	X

There are no unique natural or man-made features in the affected area.

3. Could the project(s) affect an historical or archaeological structure or site?	___	X	___	X

No historical or archeological site will be altered by the project.

4. Could the project(s) affect the potential use, extraction, or conservation of a scarce natural resource?	___	X	___	X

There are no mining operations or scarce natural resources in the area.

5. Does the project(s) area serve as a habitat, food source, nesting place, source of water, etc. for rare or endangered wildlife or fish species?	___	X	___	X

The site and surrounding area has plants and animals common to an urban setting. There are no rare or endangered species.

6. Could the project(s) affect fish, wildlife, or plant life?	___	X	___	X

There will be removal of plant and animal life from the site proper. This is not considered to be significant.

	Short Term		Long Term	
	Yes	No	Yes	No
7. Are there any rare or endangered plant species in the affected area(s)?	___	X	___	X

None have been observed or recorded in available literature.

8. Could the project(s) change existing features of any of the Commonwealth's fresh or salt waters or wetlands?	___	X	___	X

It will only have a small affect on surface runoff to the Muddy River.

9. Could the project(s) change existing features of any of the Commonwealth's beaches?	___	X	___	X

The project is remote from any beaches.

10. Could the project(s) result in the elimination of land presently utilized for agricultural purposes?	___	X	___	X

Present land use is residential and institutional. The area is not zoned for farming.

11. Will the project(s) require a variance from, or result in a violation of, any statute, ordinance, by-law, regulation or standard, the major purpose of which is to prevent or minimize damage to the environment?	___	X	___	X

Construction and operation activities will be controlled to comply with all applicable standards.

12. Will the project(s) require certification, authorization or issuance of a permit by any local, state or federal environmental control agency?	X	___	X	___

Permits from the Department of Public Health, Bureau of Air Pollution Control, and the normal and usual permits for construction will be required.

	Short Term Yes	Short Term No	Long Term Yes	Long Term No
13. Will the project(s) involve the application, use or disposal of potentially hazardous materials?	X		X	

During operation it will store No. 6 fuel oil which is not hazardous, 25,000 gallons of No. 2 fuel oil which is flammable, and 25,000 gallons of lube oil.

14. Will the project(s) involve construction of facilities in a flood plain?		X		X

This area is not a flood plain.

15. Could the project(s) result in the generation of significant amounts of noise?	X			X

Operation will not contribute a significant amount of noise.

Construction activities will have short term high sound levels.

16. Could the project(s) result in the generation of significant amounts of dust?		X		X

Measures will be used during construction to control fugitive dust.

17. Will the project(s) involve the burning of brush, trees, construction materials, etc.?		X		X

All construction materials will be disposed of off site in an approved manner.

18. Could the project(s) result in a deleterious effect on the quality of any portion of the state's air or water resources? (If yes, indicate whether surface, ground water, offshore)		X		X

Air and water discharges and noise generation will be controlled to comply with all applicable environmental standards.

	Short Term Yes	Short Term No	Long Term Yes	Long Term No
19. Could the project(s) affect an area of important scenic value?		X		X

There is no area of important scenic value in the surrounding area.

20. Will the project result in any form of environmental damage not included in the above questions?		X		X

To the best of our knowledge there will be no other areas of environmental damage.

III. Statement of No Significant Environmental Effects

A "yes" answer to any of the questions in Section II indicates that the project may cause significant environmental damage, and that an EIR will probably be required. If you have answered "yes" to one or more of the questions, but still think the project will cause no significant environmental damage, indicate your reasons below.

Permits required by the Bureau of Air Pollution Control will judge and direct the adequacy of air and noise pollution sources to ensure compliance with the applicable standards. While noise levels may be above standard levels during short term construction activities, they are fairly commonplace in this area due to many existing construction activities.

The allocation of this site for the project is consistent with institutional uses in the area. Failure to proceed with this project would necessitate having the medical area institutions obtain utilities from another supplier that could be less efficient and could create more significant environmental impacts.

IV. Conclusions

Place a check in the appropriate box.

1. ( ) It has been determined that the project will not cause significant environmental damage. No further reports will be filed.

2. (X) It has been determined that the project may cause significant environmental damage. A draft environmental impact report will be submitted on March 1, 1975 (approximate date).

The draft report will be:

3. (X) Standard 4. ( ) Extensive 5. ( ) Combined

6. Joint, in participation with _____, with _____ designated as the lead agency.

Signature of Preparing Officer _____

Title Director

Address City Hall, 1 City Hall Square, Boston

Telephone 722-4300

MASCO
TOTAL
ENERGY
PLANT
Fenway
Urban Renewal Area
Massachusetts

2. SUMMARY

Several hospitals and medical-educational facilities in the Brookline-Huntington Avenue area of Boston propose to participate in the construction and operation of a total energy plant which will be called the Medical Area Total Energy Plant. Institutions participating in this project include Harvard University, Beth Israel Hospital, Joslin Diabetes Foundation, Children's Hospital Medical Center, Sidney Farber Cancer Center, Massachusetts College of Pharmacy, New England Deaconess Hospital, and the Affiliated Hospitals Center (comprised of the Boston Hospital for Women, Peter Bent Brigham Hospital and Robert B. Brigham Hospital).[1]

The project will supply the institutions with an economical and reliable supply of electricity, steam, chilled water and refuse incineration. Its planned installed capacities are as follows:

electricity	51,892 Kw
steam	994,000 lb/hr
refrigeration in the form of chilled water	15,000 tons
refuse incineration	40 tons/day

The proposed site located in Boston is within the area bounded by Brookline Avenue, Peabody, Binney and Francis Streets and consists of approximately 1.4 acres and includes Peabody Street. Its location relative to Boston and the medical area are shown in Figures 2-1 and 2-2.

Institutions involved are currently obtaining all their steam, refrigeration requirements and part of their electrical needs from the powerhouse located at 17 Blackfan Street that was built in 1904. As demand for steam and refrigeration has increased, that plant has been expanded to the point where additional expansion is impractical if not impossible to meet the still growing needs of the institutions. By 1978 the peak steam requirements will be twice that of the firm capacity of the existing plant and there are no other sources of steam immediately

---

[1] A full definition of the ownership of this project is at the end of this summary.

Figure 2-1 Location of the Project Within the Boston Area

Figure 2-2 Location of the Site Within the Medical Area

available to the institutions. In addition, the current distribution capability of Boston Edison is not sufficient to allow for serving increased electrical requirements of the medical institutions. The total energy plant has been proposed for these reasons, and as a means of reducing cost of health care by avoiding increasing operating costs due to inflation as well as to eliminate the current method of trash handling.

The proposed total energy plant is different from conventional steam and electric plants because it combines the generation processes involved in such a manner that heat that is normally lost can be recovered. This heat recovery results in more efficient use of fuel and lower operating costs. Furthermore, a total energy plant consolidates all equipment into one area where proper engineering design can better control environmental effects. By locating the energy plant close to the users of its energy, distribution losses are reduced, condensed steam can be recovered and environmental impacts of installing long distribution networks are eliminated.

Total generation of electricity, steam and chilled water from a single plant is not a new idea. The existing Harvard power plant has been supplying electricity, steam and hot water to the medical area since 1904. Since 1968, the cost of power has been moving sharply upwards and has resulted in installation of more total energy plants to keep overhead costs to a minimum. Twenty-seven hospitals have already switched to total energy plants. One of them is New England Memorial Hospital in Stoneham which now has 15 years of successful operating experiences.

Location of the energy plant within the urban area is not unusual because most steam and electric plants must be near the users to minimize distribution losses. Examples of steam and electric plants located within the Boston urban area are Boston Edison's steam stations at Minot, L, Scotia and Kneeland Streets and Cambridge Electric Light Company's electric generating plant on Memorial Drive.

Project

The proposed facility consists of the plant itself, diesel generators, steam boilers, a steam turbine, centrifugal chillers, incinerators, heat recovery boilers, a cooling tower, a 300 foot stack, underground fuel

oil storage tanks and an underground system for distributing the services to the institutions. More details of the facility are contained in Section 3 of this report.

The major stages in this project include demolition of the buildings now on the site, excavation and construction of the plant and distribution tunnel and operation of the plant until age or obsolescence requires termination.

When the project is complete it will serve the medical area institutions with electricity, steam, chilled water and incineration independently from the public utility system; and the existing power plant will be razed.

Project Setting

The proposed project is to be within the City of Boston in an area characterized by institutional, residential and commercial uses. Due to increasing needs of medical care facilities, the institutional nature of the area has been growing with most of the growth occurring since the 1960's. The site, itself, about 1.4 acres, has been used for institutional and residential purposes; most of the structures on the site are showing signs of neglect and some are vacant. Harvard University either owns or has entered agreements for the acquisition of all property within the site except for the row house at the corner of Brookline Avenue and Peabody Street.

Residential areas are adjacent to the southern side of the site and institutional and commercial uses surround the other sides. This area of Boston has two main problems:

1) deterioration of housing stock, and

2) parking and traffic congestion along with community concerns of institutional expansion.

Other major projects are planned for this area of which the most significant are the Mission Park Housing Development to be located in the Vining Street parking lot and the Affiliated Hospitals Center just east of the proposed project. More details of the existing environment of the project area are contained in Section 4 of this report.

Major Benefits

The major benefit of this project and the main reason it has been proposed is reduced costs of utilities through high efficiency, and high reliability of generation. This will help keep the cost of health care down. The efficiency comes from interrelating all the generating processes so that the most service can be provided for the least amount of fuel. Annual savings from this plant will be substantial when compared to costs of purchasing the necessary steam and electricity from Boston Edison.

This is not an implication that Boston Edison Company is not an efficient producer of utilities, but rather that the design of the proposed plant to meet the specific requirements of the medical institutions can be more efficient than a large-scale generating and transmission system that must meet the general needs of many customers. The savings produced by the energy plant will help to minimize operating costs of the medical institutions and will serve to avoid some of the effects of inflation on costs of patient care, research and medical education.

High reliability, having the proper amount of energy when it is needed, is essential to maintain normal hospital routine. This is produced in the proposed project by having sufficient backup equipment to allow for a continuous source of energy even during periods of unscheduled maintenance.

There are other benefits both to the local area, City of Boston and the nation. Conservation of fuel will be a significant national benefit expecially during the present energy situation; approximately 6,150,000 gallons of No. 6 oil will be saved each year compared to making chilled water and steam and purchasing electricity. The cost savings will help maintain and promote medical care, research and education which is a national as well as a more local benefit. In this stage of the nation's economy, the jobs created for production of the equipment, construction materials, engineering, architecture and construction will help provide employment.

The City of Boston will benefit because the proposed project will make payments to the city in lieu of taxes well in excess of the $59,403 currently generated by the site. An exact figure for these payments has

not yet been established. The sanitary land fills in the area will be used less to dispose of the trash produced in the medical area since the incinerator incorporated into the project will reduce the weight necessary for disposal by approximately 80%. Net truck traffic through Boston will be reduced by about an average of 130 trucks per month. This will be due to the elimination of trash trucks which will more than offset the increase of fuel delivery trucks. Water consumption of about 200,000,000 gallons per year will be avoided as compared to other means of generating utilities by recovering the condensed steam. Furthermore, emission of about 465,960 lbs of SO_2 and 44,200 lbs of particulate will be avoided as compared to making chilled water and steam and purchasing electricity.

The new power plant will directly serve the community by supplying hot water for heat and domestic use, and solid waste incineration to the Mission Park Housing Development at a lower cost than could be produced by that project itself due to efficiencies of operation of the total energy plant. The power plant will also benefit the more immediate site area by allowing removal of the existing power plant. This will remove the visible vapor plumes that occur from that facility and will lower noise levels in the neighborhood. Furthermore, the net reduction of an average of 130 trucks per month through the medical area will reduce truck-related impacts of noise and vehicle emissions.

Costs and Environmental Impact

The financial cost of this project is given to help present the extent of this project. Costs including real estate acquisition, site development, engineering studies, equipment and construction will be approximately $48,000,000.

The following subsections are summaries of the probable environmental impacts during construction and operation that are presented in more detail in Section 5 of this report.

Environmental Impacts During Construction

During construction there will be much activity on the site and in the institutional area for demolition of the existing buildings, excavation for the foundation and distribution tunnel, pouring concrete for the foundation and walls, erection of the steel framework and installation

Land Use

The existing institutional and residential uses of the site are being removed to make room for the project. Institutional activities will be relocated within the medical area and there will be a loss of residential buildings that have a potential for 97 dwelling units. However, the Mission Park Housing Development and other housing projects will increase housing in the area. This makes total allocation of the land to an institutional use only a minor impact. There will be no interference with access to adjacent land uses and there will be no interference with community services or utilities. No historical or archeological areas will be effected. The visual appearance of construction may detract from Olmsted Park, although very little will be visible because of the low profile of the building. Movement of trucks may produce some traffic congestion when combined with traffic from other projects in the area and will place a demand on the traffic patrol of the police force. The city will be reimbursed for the use of any patrolmen required. Parking in the area will be aggravated by the loss of parking spaces along Peabody and Francis Streets and the concurrent closing of the parking lot where the Mission Park Housing Development will be built. These problems may be alleviated by MASCO parking plans. All necessary permits will be obtained for transporting any generating equipment to the site which is over the allowable load limit set by a recent regulation.

Environmental Impacts of Operation

Air Quality

Operation of the proposed plant will contribute only small concentrations of sulfur dioxide, particulates and nitrogen oxides to the ground level ambient levels. No contribution of these contaminants will exceed 5% of the applicable standards. Removal of the existing power plant will further decrease the air quality impact of the proposed project.

The cooling tower will not produce any visible vapor plume because of its design to heat the air leaving the tower with the jacket water from the diesels. Thus no fogging or icing should occur. Drift from

the tower, even assuming worst case conditions, does not produce significant impact.

Emissions of carbon monoxide and hydrocarbons from truck traffic due to fuel deliveries and ash removal along Francis Street, will be only a small increase due to existing high level of vehicular activity on Brookline Avenue. The net average reduction of 130 trucks in the area per month may be a benefit to overall existing vehicle emission levels.

Hydrology

By making the area of the plant impervious to surface water, the existing site runoff will increase from 1.58 cfs to 2.57 cfs during a 10-year design storm. This should not have any impact on the peak flow of the Muddy River of 400 cfs.

Water Quality

The quality of runoff from the site will be improved by the proposed project due primarily to removal of parking in the alleys on the site and along Peabody Street. Oil spill prevention and containment procedures will be followed to prevent oil contamination of surface or ground waters. The sanitary load will be less than 0.01% of the dry weather day to day flow variation of the Deer Island treatment plant and should not be noticeable. Total water consumption will be about 0.2% of Boston's yearly water demand and 0.75% of the maximum daily water demand. Chemicals added to the circulating water flow will not affect the Deer Island treatment plant or ecology in Boston Harbor in the discharge concentrations. Cooling tower blowdown will be in accordance with the pretreatment standards for discharge to a publicly owned treatment work from a steam electric power generation point source.

Geology and Geohydrology

Geological and geohydrological characteristics of the area will not be affected by the project because it does not obstruct the local water table, and the impervious nature of the site will preclude surface water infiltration.

Noise

Noise levels in the area will decrease upon completion of the proposed project and termination of the existing plant. This is due to shielding of equipment, the counterflow cooling tower, having most of the air to the cooling tower come from within the building, sound attenuated air intakes to the building and an enclosed fuel oil unloading and ash removal area. Buildings along Francis Street will experience noise from the trucks leaving the site of 86 to 84 dBA. This is not a new impact since large trucks currently travel through the area.

Ecology

Use of the site for the power plant will prevent it from providing wildlife habitat. However, since it does not now provide extensive habitat and there are no rare or endangered species, this produces no impact.

Social and Economic Characteristics

This project will further change the character of the area from residential to institutional. It is expected that the Mission Park Housing project will help retain the character of the neighborhood.

Operation of the project is not expected to affect Boston Edison's rates. This project, although it will be exempt from real estate taxes will make payments to the city in lieu of taxes. While the amount has not been established, it will exceed the current tax payments of $59,403 from the site. There will be no significant increase in employment since the staff will only be about 18 and will probably be made up of workers now at the existing power plant.

Land Use

Peabody Street will be closed to cars and trucks but a pedestrian arcade will permit access between the medical facilities and Brookline Avenue. No adjacent present or proposed land use will be discontinued or changed because of the power plant. The Frederika Home will have a more secluded area and a quieter surrounding as a result of the new

power plant and the closing of Peabody Street. There will be no obstruction of access to any medical facilities or land uses in the area.

The most prominent part of the project will be its 300 foot stack which will be visible from Parker Hill and the surrounding area. It will tend to blend in with the other tall structures in the area. During operation there will be no demands placed on community services. Finally, the power plant will not produce any electromagnetic waves that would interfere with radio or T.V. reception.

Measures Being Used to Minimize Environmental Damage

The plant has been designed to use as little fuel as possible to reduce air contaminant emissions, to recover steam condensate, to contribute only small concentrations to ground level concentrations and to provide a net reduction in noise levels and truck traffic through the area.

Impacts of construction will be controlled by standard practices of controlling fugitive dust, adherence to applicable load carrying regulations and scheduling truck movements and work hours to avoid peak traffic conditions.

Operational controls will ensure proper combustion efficiency which will reduce emission from the processes. Cyclone collectors and a complying fuel will limit particulate and SO_2 emissions. Fuel delivery and ash removal will be scheduled to avoid neighborhood disturbances.

Construction of other projects in the area will contribute to noise, traffic congestion, parking problems and fugitive dust during construction. Other area projects such as the dredging of Muddy River by the BRA and DPH and diversion of water to Quabbin Reservoir by the MDC will not affect or be affected by the project.

The only unavoidable adverse impact will be the short-term noise and annoyance of pile and sheet driving at the site. This should not last more than one month but will disturb residents and those within the medical area. Parking and traffic will also be an adverse impact during the construction period because of concurrent closings of parking lots. However, traffic control and parking plans for commuters and construction workers may alleviate this situation. Arrangements are being made

for the workers to park at lots away from this area. All of the above information is described in more detail in Section 6 of this report.

Alternatives

Alternatives are briefly summarized here since they have been an integral part of planning for this facility.

Alternatives of taking no action, deferring the action, using different suppliers of utilities, other sites and various design features have been considered for minimizing environmental effects and these are discussed in Section 7 of this report.

A major criterion in evaluating alternatives has been their ability to allow the project to meet its goal of serving the institutions reliably and efficiently. In order to meet this goal some action must be taken now to supply the growing utility needs of the institutions. The criterion eliminates the use of other utility sources such as Boston Edison for steam and electricity because of higher costs and lack of reliability that only an independent source of energy can produce. Alternative sources would also result in comparable if not greater environmental effects within the Boston urban area.

The criterion is met best with the project close to the institutions which it will serve to reduce distribution losses. This has kept consideration of alternative sites within the area designated as the project area. Time schedules, construction difficulties, existing land uses and community review directed the site selection to the proposed location. None of the alternative sites considered would serve to minimize environmental effects.

Two alternative building designs were considered:

1) refurbishing the row houses along Brookline Avenue, or providing a small entry way instead of office space.

2) rearranging the building around a piece of property that Harvard University may not be able to purchase.

It was decided that replacement of the row houses would be preferable due to need for more space designed especially for office use and need to remove the row houses at a future date to allow installation of additional equipment. The second design alternative has not been eliminated since negotiations for the purchase of the remaining building have not been successful. This alternative has a slightly greater degree of impact than the proposed design because of the proximity to the residential building.

The inner city site location also makes oil the most appropriate fuel because of the problems of handling and burning coal, regulations preventing use of nuclear fuel and scarcity of natural gas. Offsite fuel unloading and storage would not be feasible in the area because of the distance that would be required before any benefit would be achieved and associated problems of pumping the oil to the site.

The criterion also limits the size of individual generating units to allow for meeting full demand during scheduled and unscheduled maintenance periods. This has eliminated condensing steam turbines and combined cycle gas turbines, both of which would result in lower NO_x emissions. The planned design using low sulfur oil does not warrant the use of alternative emission control equipment for SO_2 or particulates. Emission controls for NO_x have not been sufficiently effective or prepared for commercial operation to be included in this project.

Definition of the Project Ownership

Medical Area Service Corporation (MASCO) is a non-profit membership corporation organized under Chapter 180 of the General Laws of Massachusetts. For the purposes of Massachusetts law it is a public charity and is exempt from Massachusetts real property taxes. For the purposes of the Federal Internal Revenue Code, it is taxed as a corporation. Its members are the Beth Israel Hospital Association, Boston Hospital for Women, Sidney Farber Cancer Center Inc., The Children's Hospital Medical Center, Joslin Diabetes Foundation, Inc., New England Deaconess Hospital, Peter Bent Brigham Hospital, President and Fellows of Harvard College, Robert B. Brigham Hospital, and Massachusetts College of Pharmacy. (Boston Hospital for Women, Peter Bent Brigham Hospital,

and Robert B. Brigham Hospital have since merged, effective January 1, 1975, into a single corporation, Affiliated Hospitals Center, Inc.) Only corporations, trusts, and fundations operated exclusively for charitable medical, scientific, or educational purposes and qualifying for exemptions from state income taxes and from federal income taxes under the provisions of 501(c)(3) of the Internal Revenue Code are eligible for membership.

The title to the proposed medical area power plant will be held either by an urban development corporation organized under Chapter 121A of the General Laws of The Commonwealth of Massachusetts which will purchase the fee from Harvard subject to an agreement granting Harvard the right to repurchase the property, or else the fee will be retained by Harvard, leased to MASCO on a long-term lease and used by the Chapter 121A corporation under an agreement pursuant to which the Chapter 121A corporation will own the building and equipment constructed on the leased land. The Chapter 121A corporation will in turn lease the building and equipment to MASCO which will occupy and manage the facility.

Consultants and Companies That Have Aided This Project

A great amount of planning has been applied to this project and many companies have been contracted to aid in its evaluation, design, and construction. This environmental impact statement has been prepared by Environmental Research & Technology, Inc. The following is a list of companies contributing to this project and their area of involvement:

Charles Hilgenhurst Associates - Area Planning and Design Guidelines
Wilbur Smith Associates - Traffic Analysis and Planning
William Cavanaugh - Acoustical and Noise Consultation
Ben Thompson Associates - Architecture
Nichols Norton Zoldastani - Structural Engineering Consultation
Paul L. Geiringer Associates - Power Plant Engineering Consultation
Geotechnical Engineering - Soil and Foundation Consultation
Gilbane Building Company - Building Construction and Cost Estimation
Arthur D. Little - Fuel Selection Consultation
Environmental Research and Technology - Environmental Impact Analysis
Dr. James Halitsky - Meteorological Consultation

3. DESCRIPTION OF THE PROJECT

3.1 Type of Project

Proposed Project

The Medical Area Total Energy Plant will supply steam, electricity, chilled water, and refuse incineration service to the cooperating institutions while combining operations to obtain maximum operating efficiency and reliability. Major equipment and capacities involved in the project are as follows:

Electricity	51,892 Kw	6 diesel engine driven generators @ 6,932 Kw and one steam turbine driven generator @ 10,300 Kw
Steam	900,000 lb/hr 94,000 lb/hr	5 steam boilers @ 180,000 lb/hr from heat recovery boilers
Refrigeration	15,000 ton	4 5,000 ton centrifugal water chillers (only 3 chillers can operate at any one time)
Refuse Incineration	40 tons/day	2 units @ 20 tons/day
Plant Cooling	42,840 gpm water flow	mechanical draft cooling tower
Fuel Oil Storage		underground tanks, 1,100,000 gallons No. 6 oil, 25,000 gallons No. 2 fuel oil, and 25,000 gallons lube oil

All combustion equipment will burn No. 6 residual oil, during normal operation and No. 2 fuel oil will be used when equipment is started up or shut down. All combustion equipment will be interrelated so that exhaust heat can be recovered.

The steam, chilled water, and electricity will be distributed to the users through an existing tunnel system with new extensions. The utility tunnel will be about 11 feet wide and 13 feet high so that conduits can be serviced from within.

Waste disposal system will consist of a network of pneumatic pipes also housed in the utility distribution tunnel. It will permit solid waste from the institutions to be collected at each source point and transported directly to the energy plant for incineration.

Present Operations that Can Be Discontinued When the Project Is Complete

The existing powerhouse which began operation in 1904 to serve the Harvard Medical Institution has since been enlarged and modified so that its present capacities are as follows:

steam	385,000 lbs/hr (firm capacity)
electricity	2,000 kw (installed capacity)
chilled water	6,300 tons (installed capacity)

It consists of seven steam boilers, four water chillers, two steam turbine driven generators, one large three-cell cooling tower, two small cooling towers and three stacks ranging from 175 feet to 186 feet in height. There is oil storage capacity for three days and 10 to 15 trucks deliver oil each day.

Construction in the area since the initial installation of the powerhouse has now caused it to be immediately surrounded by buildings of the Children's Hospital and other institutions. When the powerhouse is razed, the land can be used for medical facilities and the significant nuisance aspects of the obsolete plant will be eliminated.

Solid waste collected in the medical area is now removed by private collection companies for disposal in sanitary landfills. Trash at the institutions is stored in large bins where it is picked up at regular intervals. In 1973 approximately $200,000 was spent by the MASCO institutions for this trash removal service, and it has been estimated by MASCO that 5,200 truck trips were required.

This situation results in noise from the trucks, unsightly refuse containers and scattered trash from improper storage. The proposed facility will eliminate the need for trash bins and waste removal trucks traveling among the institutions and Mission Park Housing.

3.2 Objectives and Benefits of the Project

The objective of this project is to 1) keep the costs of medical service down by efficient production of utilities and 2) provide enough

reliability so that the medical facilities can maintain their necessary level of activity at all times. It will also provide hot water and incineration service to the Mission Park Housing Development.

Since all the utility generating equipment will be physically situated together, they will be interrelated to save fuel. For example, steam will be produced as part of the electricity generation process from exhaust heat that would ordinarily be wasted, and electricity will be a byproduct of the major steam production. Because of these economies, annual savings from the total energy plant are initially expected to be about $1,980,000 as compared to making chilled water and steam and purchasing electricity from another source.

In order to maintain reliability, the equipment for the facility has been designed and selected so that there will always be enough backup service when some equipment is being serviced. This will free the institutions from drops in steam pressure, decrease in voltage and possible blackouts which could occur if they were dependent on outside sources of utilities.

The benefits of this project are as follows:

1) Lower cost of utilities throughout the operating life of the project which will help keep the cost of health care down.

2) Efficient production of utilities which minimizes fuel consumption. Approximately 6,150,000 additional gallons of oil would be required each year to produce the utility needs if the energy plant were to produce only chilled water and steam.

3) Establishment of a supply of utilities that is consistent with modernization and expansion of medical facilities. This will allow the institutions to better control their own growth.

4) Provision for a reliable source of utilities to free the institutions from problems of a public utility.

5) Provision for utilities that fit the operating characteristics of the institutions; electric voltages and steam pressures that will suit the hospitals.

6) Minimization of environmental impacts by centralizing the generation of utilities.

7) Incineration of refuse thereby reducing landfill pollution and capacity problems.

8) Reduction of trash trucks and trash bins within the medical area and the Mission Park Housing Development.

9) Removal of the existing power plant which will reduce noise levels and emissions generated by that source.

10) Supply utilities with a minimum of distribution losses.

11) Recovery of condensed steam thereby conserving water and reducing the load to the Deer Island Treatment Plant.

3.3 General Characteristics

The proposed energy plant will be a brick, steel and concrete building approximately 290 feet long, 220 feet wide, 30 feet to the top of the building, 90 feet to the top of the cooling tower and will include a stack about 20 feet in outside diameter and 300 feet high. The project will use almost all of the site and include Peabody Street. A pedestrian arcade will connect Binney Street and Brookline Avenue as a replacement for the roadway and to allow access to the medical institutions from Brookline Avenue. Office space for MASCO has been planned along the Brookline Avenue side of the site to present a modern office building to street level travelers. The truck docking area will be inside the building along Binney Street. A plan view of the project is shown in Figure 3.3-1.

Views of the exterior of the project from Brookline Avenue, Francis Street and Binney Street, as currently planned, are shown in artist sketches in Figure 3.3-2, 3.3-3 and 3.3-4.

It is likely that architectural treatments will change as the project progresses. For example, designs of the cooling towers are being

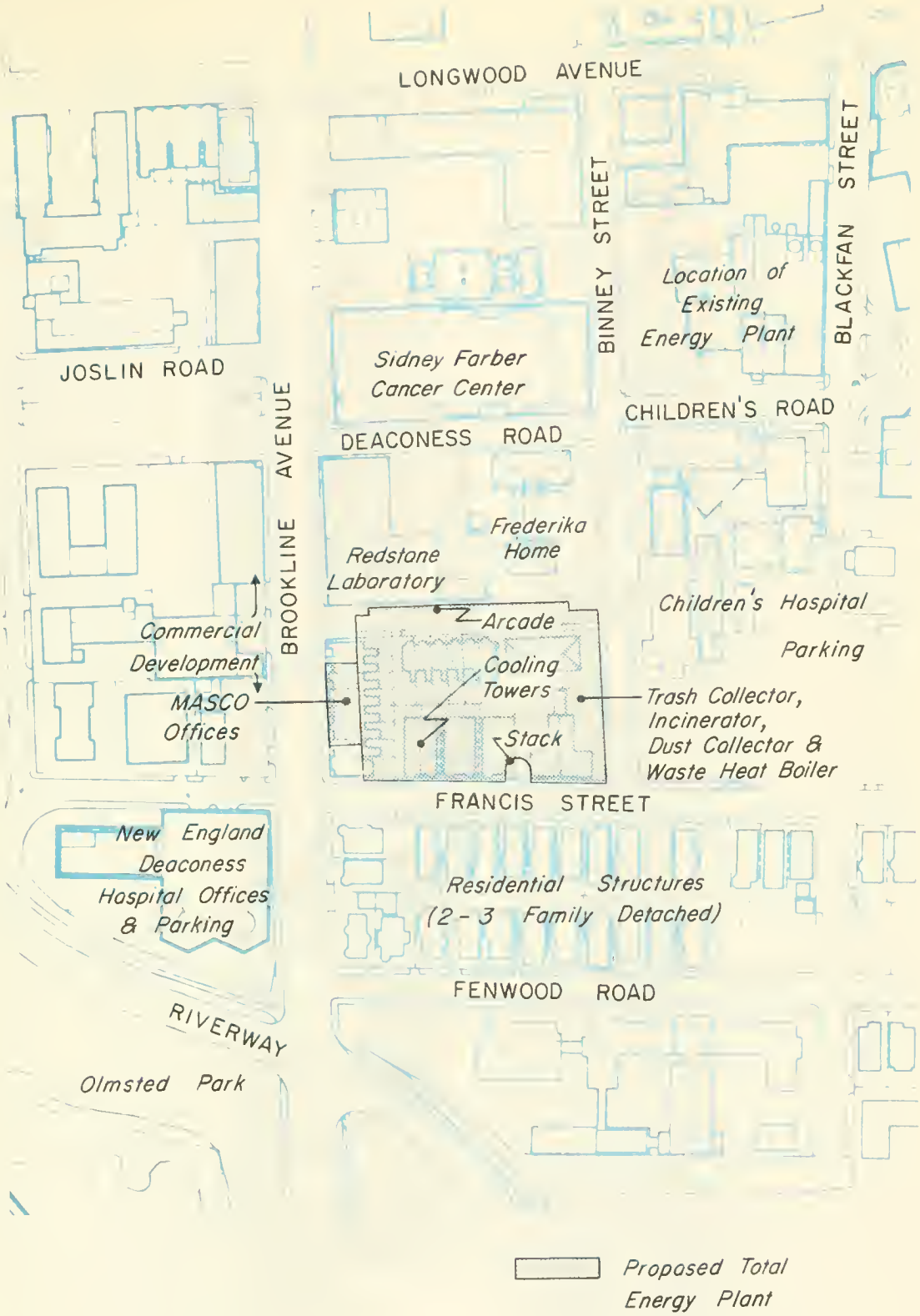

Figure 3.3-1 Plan View of the Proposed Energy Plant

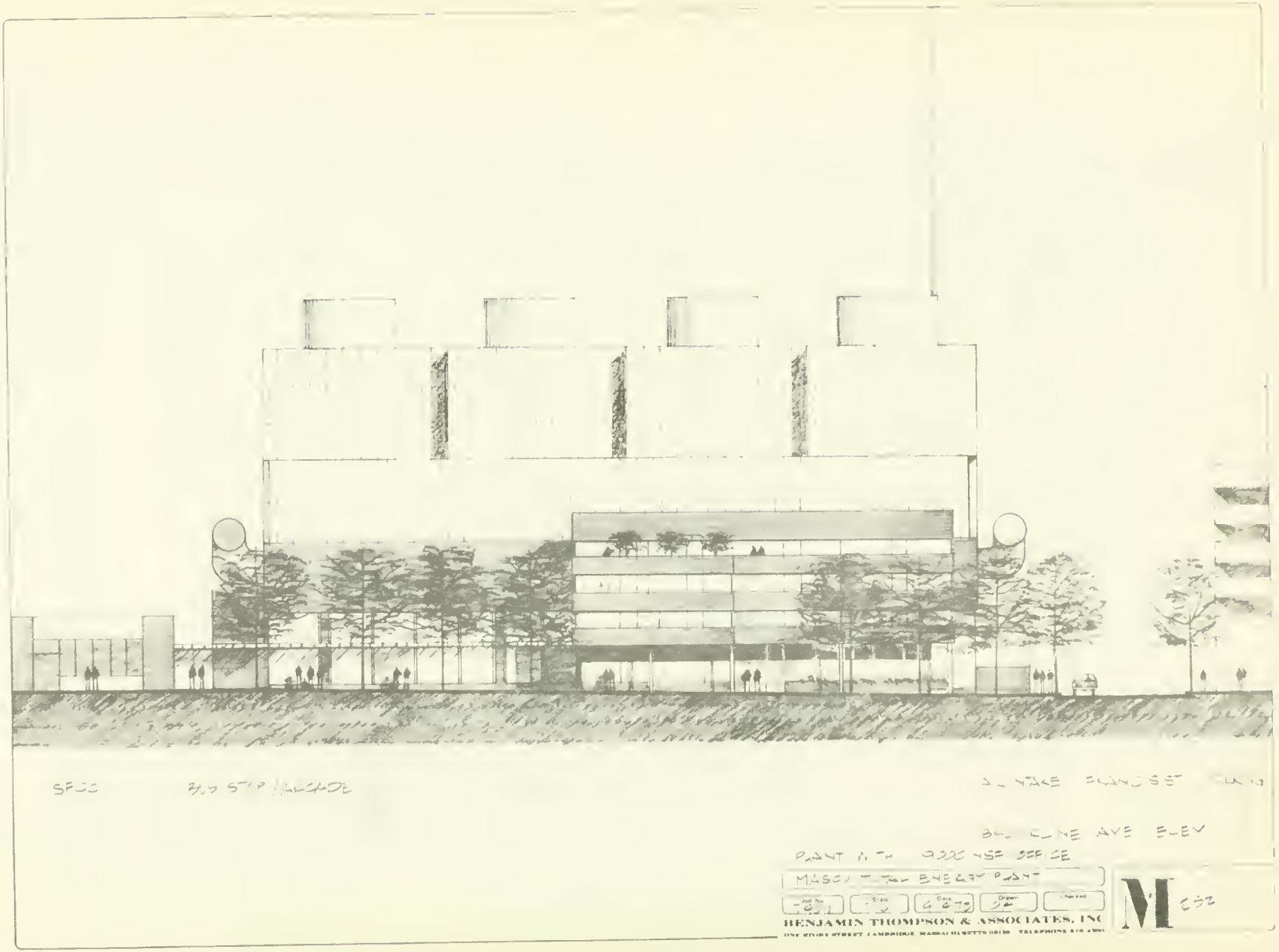

Figure 3.3-2 Brookline Avenue Elevation of the Proposed Project

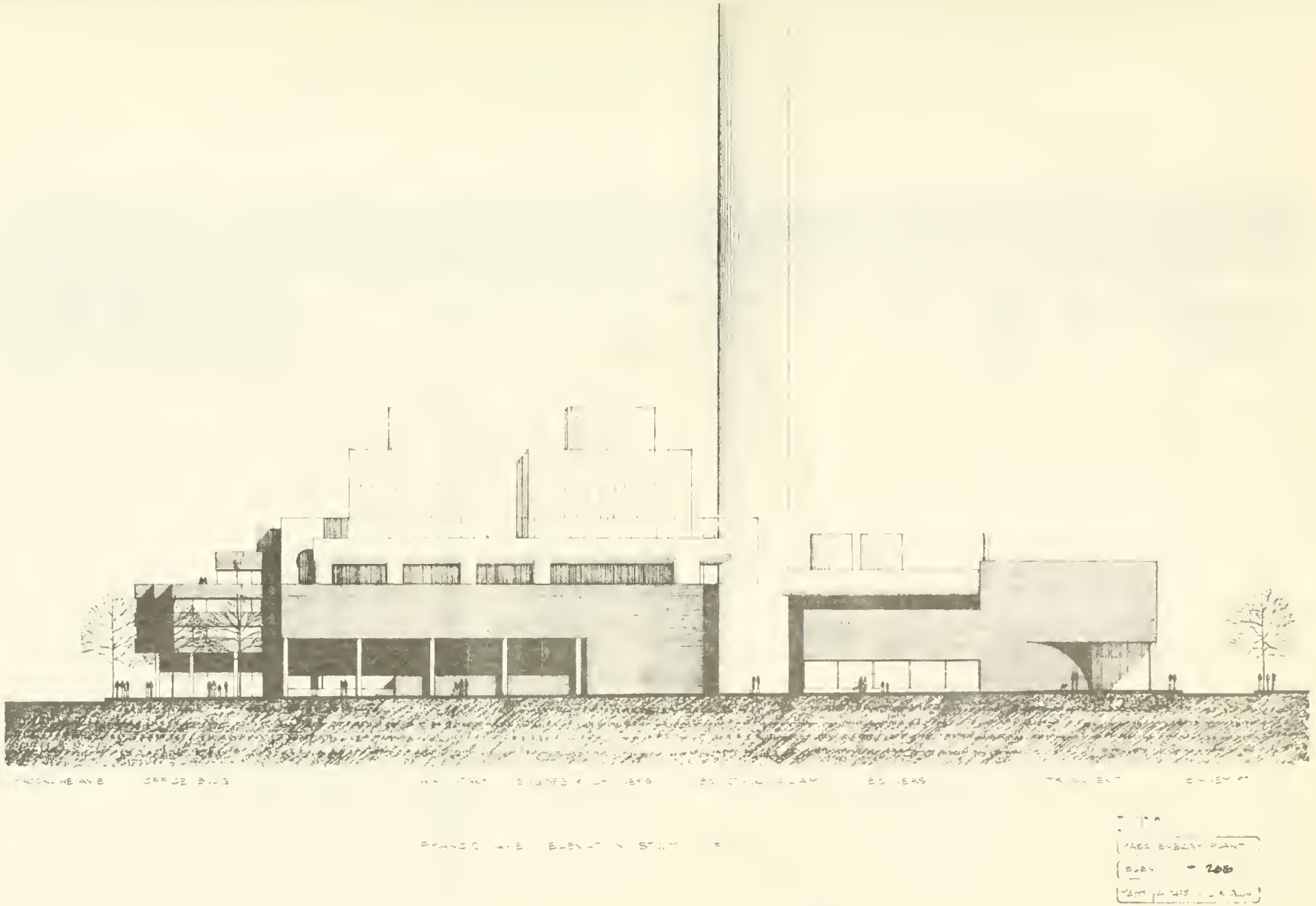

Figure 3.3-3 Francis Street Elevation of the Proposed Project

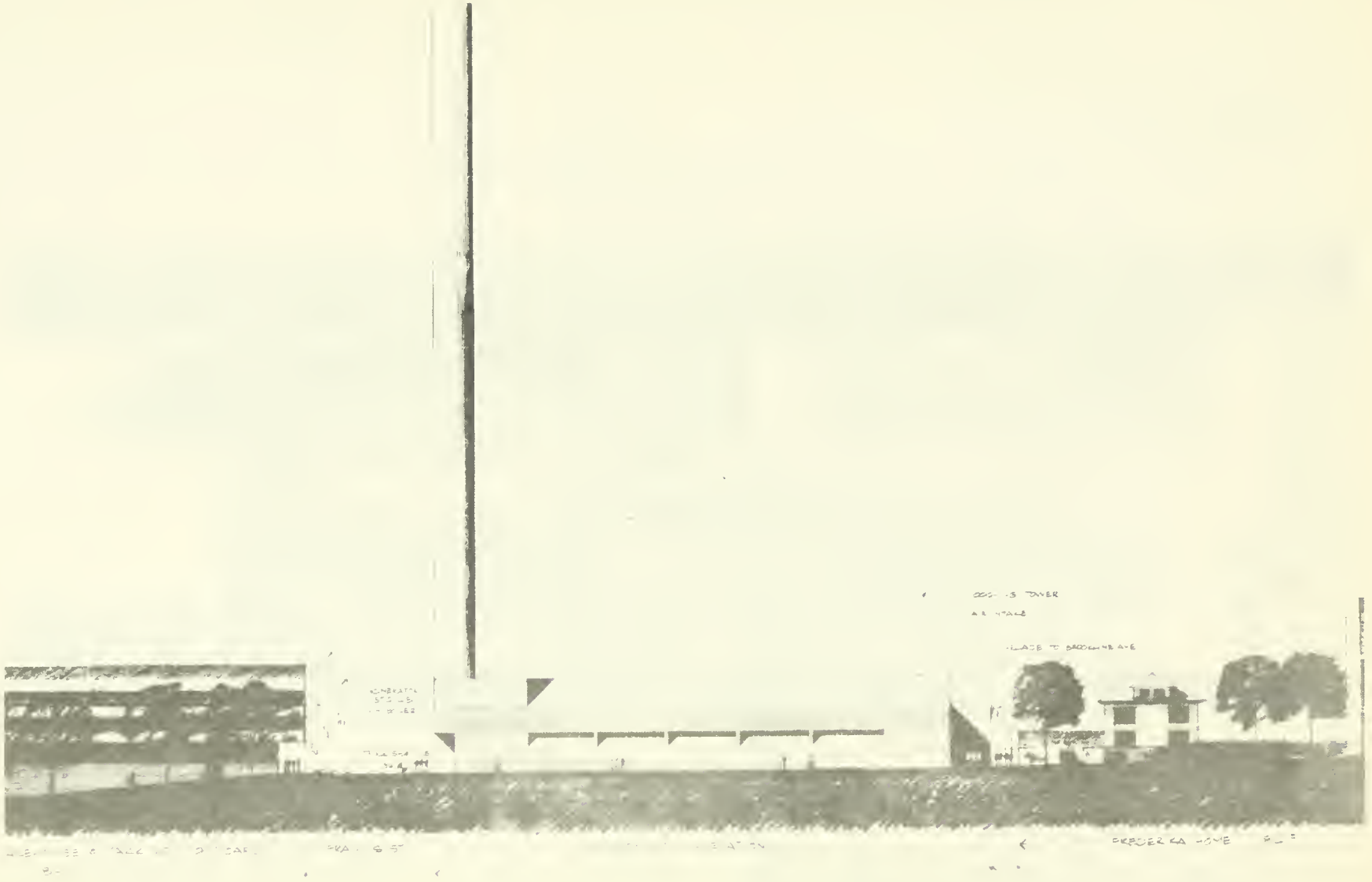

Figure 3.3-4 Binney Street Elevation of the Proposed Project

examined for ways to reduce their mass while retaining their necessary function.

Construction of the project consists of demolishing the structures on the site, excavating to an elevation of 24 feet (10 to 15 feet below grade), installing spread footings with a slab on grade for the foundation, erecting steel and pouring concrete walls and installing the equipment. It will also include excavating to a depth of about 15 feet and width of 11 feet for a length of about 1,900 feet to install the distribution tunnel. This will be hidden from view after construction ends. The construction of the building shell alone will take 8 to 12 months and the entire project will take about two and one-half years. Total installed costs including the land and its development will be about $48,000,000.

Operation of the project will continue for about 40 years or until obsolescence requires upgrading or demolition.

3.4 Project Timetable

Projection of the energy needs of the institutions has shown that the total energy plant must be in operation at the beginning of 1978. It is expected that environmental approvals will be received by July 1975 and that demolition of existing structures on the site should begin in the fall of 1975. Full operation is planned for 1978.

3.5 Technical Description

This section provides a more technical description of the equipment to be installed in the power plant. A machine layout and an elevation view of the power plant is presented in Figure 3.5-1 and Figure 3.5-2 and a flow diagram of electric power, steam, and chilled water is in Figure 3.5-3.

Power Generation

Electric power will be produced by six medium speed diesel driven generators each rated at 6,932 Kw. The diesels, manufactured by Mirrless Blackstone, are fuel injected, turbo charged 16-cyclinder engines each with a peak consumption rate of No. 6 oil of 3500 lb/hr.

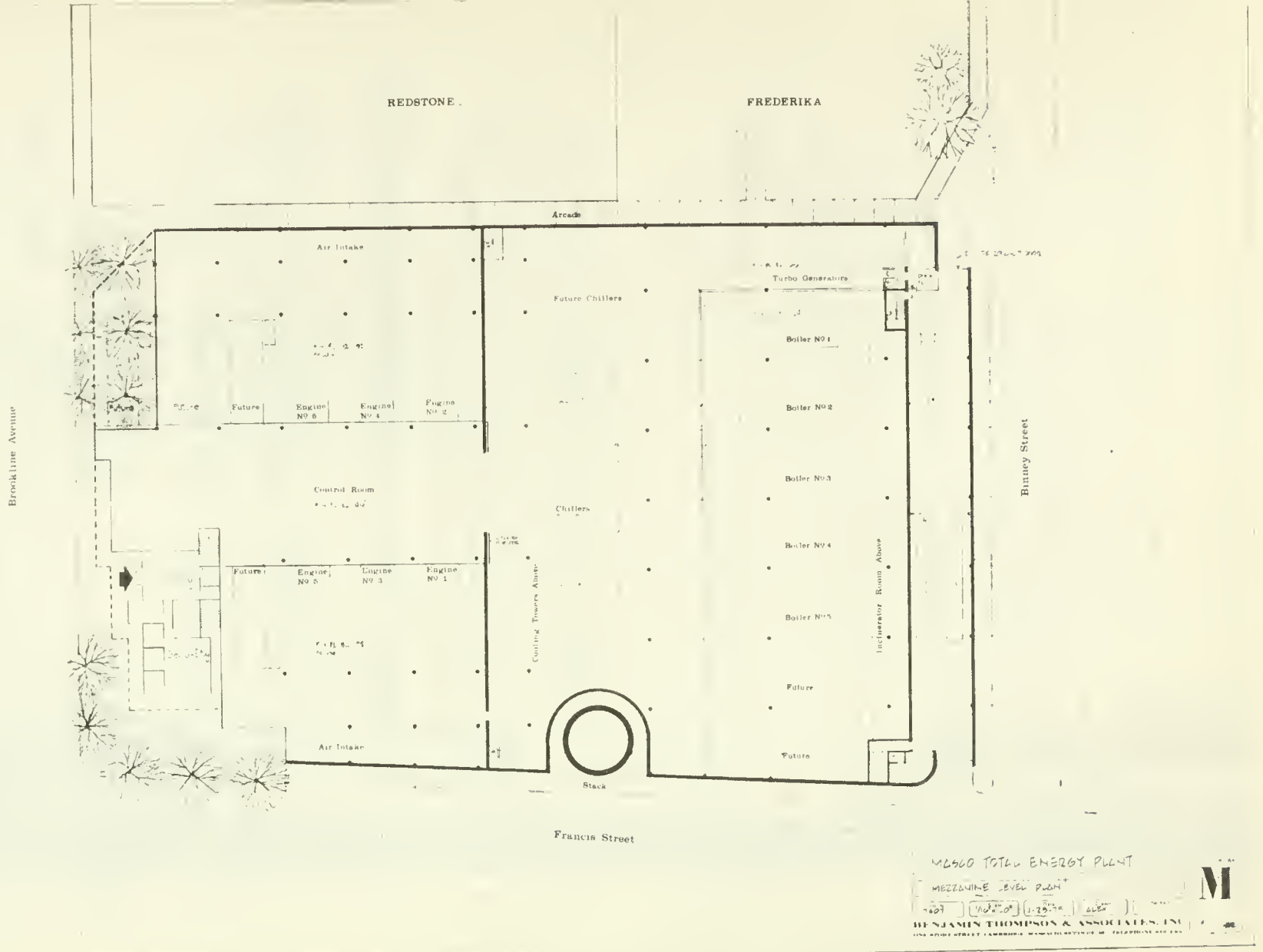

Figure 3.5-1 Plan View of the Equipment Layout

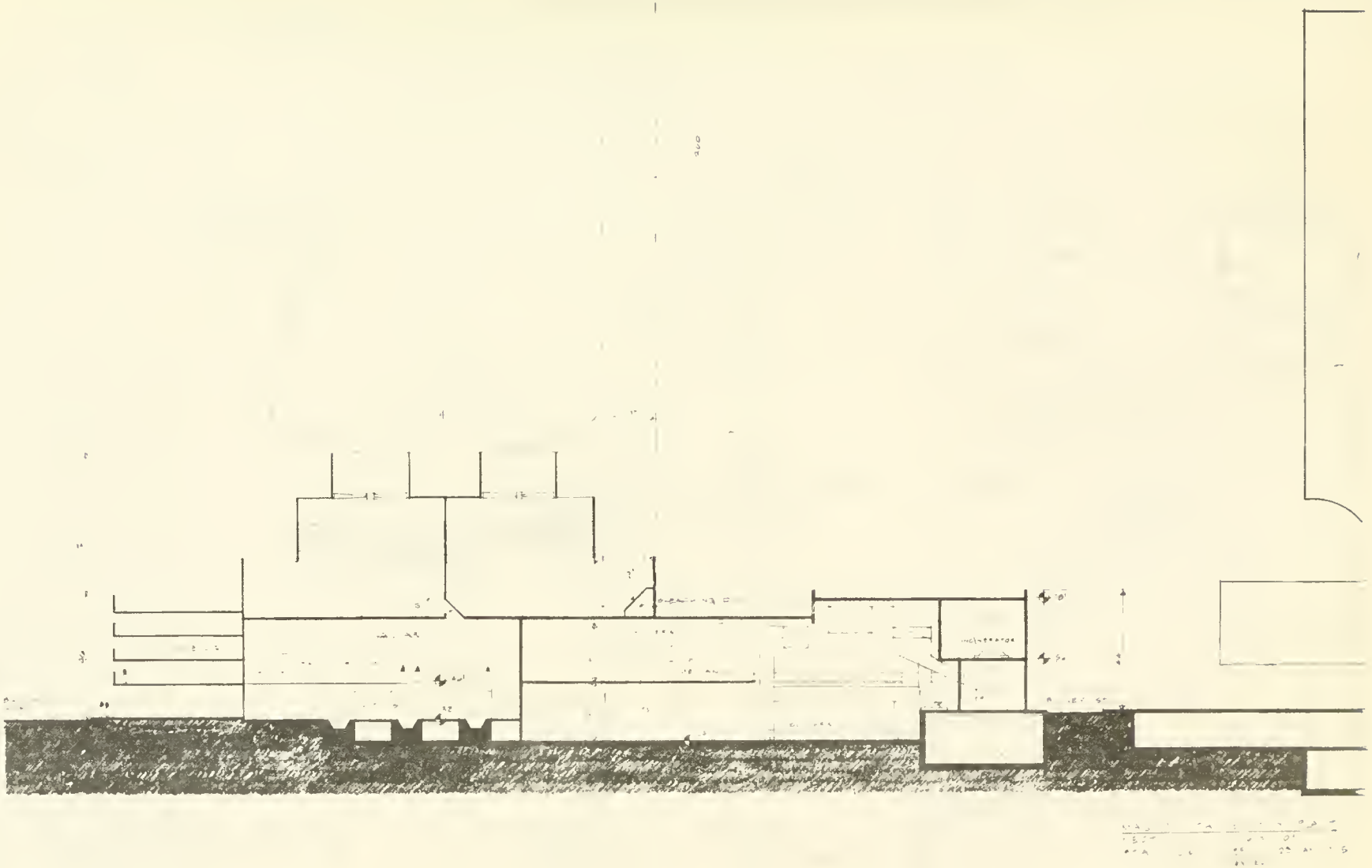

Figure 3.5-2 Elevation Section of the Equipment Layout

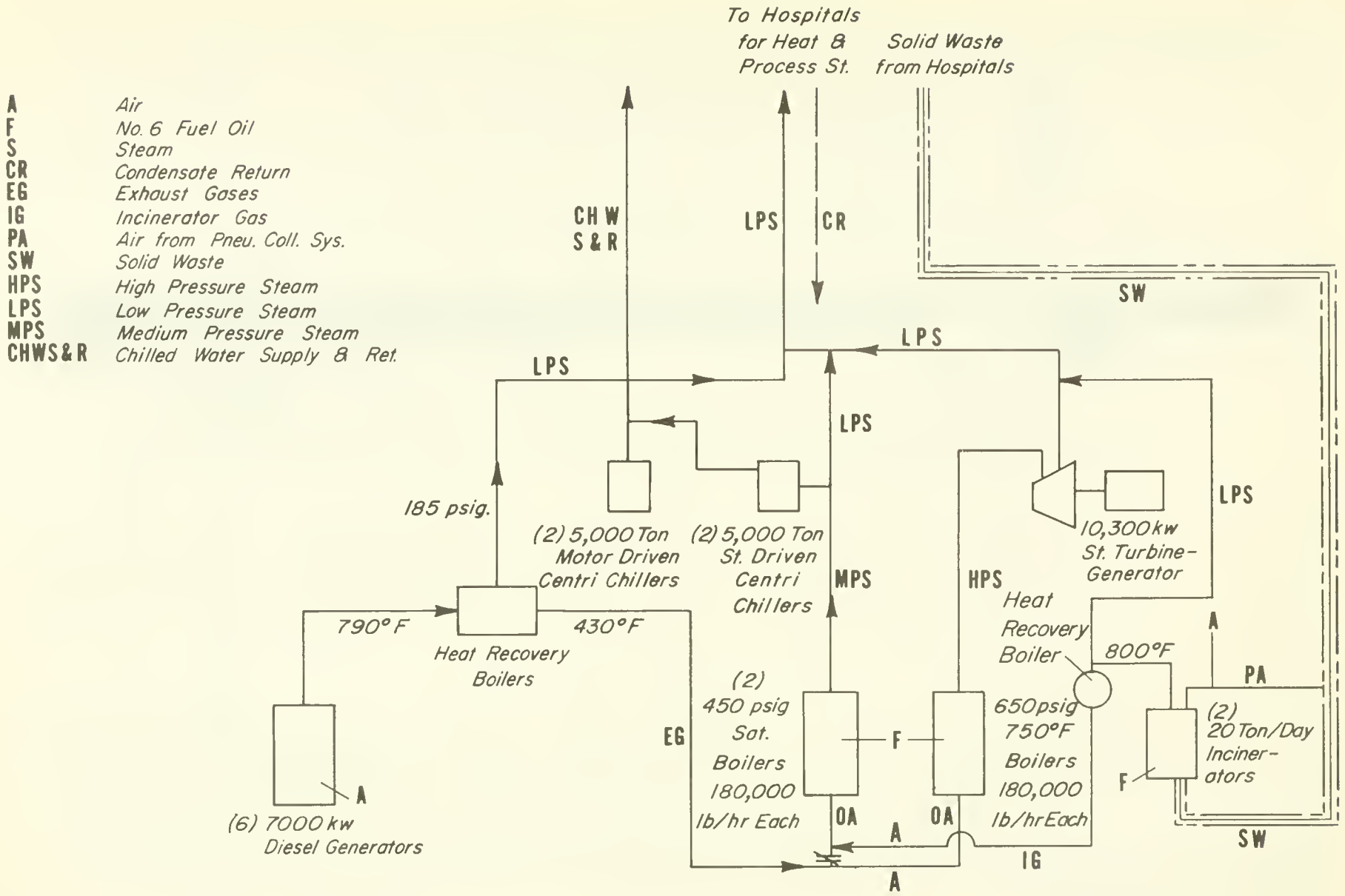

Figure 3.5-3 Flow Diagram for Electricity Steam and Chilled Water

All of the diesels will exhaust into separate heat recovery boilers which will use the heat of the exhaust to produce a maximum of about 80,000 lbs of saturated steam per hour at 185 psig. No fuel will be burned in these boilers. The exhaust gases will then be used as partial combustion air for the steam boilers.

Of the six diesels, one will be kept on a standby basis, and one will be available for maintenance.

Electric power will also be generated by a back pressure steam turbine driven generator rated at 10,300 Kw. Steam from the high pressure steam boilers described below will drive this turbine before being distributed to the institutions at 185 psig through the distribution tunnel.

Steam Boilers

Five steam boilers manufactured by the Riley Stoker Corporation will be installed. Each boiler will have a single, steam atomizing, Coen oil burner that will allow exhaust gases from the engines and incinerators to be used as partial combustion air. Three of these are high pressure units each with a steam production of 180,000 lb/hr at 650 psig and 750°F and a consumption rate of No. 6 residual oil of approximately 12,800 lb/hr. Steam from these units will drive the back pressure steam turbine generator before distribution. The other two boilers are saturated steam units with a steam production of 180,000 lb/hr at 450 psig and a fuel consumption rate of approximately 10,900 lb/hr. Steam from these units will drive the centrifugal water chillers.

The steam system has been designed so that all uncontaminated condensate will be returned.

Incinerators

Two 20 ton/day incinerators will be installed each having the capacity to handle the institutions' load during a 17-hour period. These incinerators will be used only for general refuse. They will be designed with a dumping grate and refractory furnace operating with 200 to 300% excess air. Flue gas temperature will be about 800°F before entering the heat recovery boiler. Operation will be on a batch basis to ensure complete combustion. Auxiliary fuel will be No. 6 residual oil at a

rate of approximately 100 gal/hr. Flue gases will be used as partial combustion air for the two saturated steam boilers which will act as afterburners and eliminate any odors. Heat recovery boilers will be used after the incinerators each with a capability to produce approximately 7,000 lb of steam/hr at 185 psig to recover as much heat as possible from this operation.

Water Chillers

Four 5,000 ton centrifugal chilled water generators will be provided for air conditioning. Two of these units will be driven by steam turbines and two by electric motors; only three can be operated at any one time because the cooling tower has not been sized to remove the heat from four chillers. It is planned that a steam turbine driven chiller will be kept on a standby basis and the motor driven chillers will be used most frequently, since this will take advantage of the efficiency of the diesel and turbine generators.

Circulating Water System and Cooling Tower

The circulating water system removes heat from the chilled water units and auxiliary equipment such as the turbocharge intercoolers, lube oil system and pump bearings. Cooling requirements will vary depending on both the number of chillers that will be operating and whether the turbine or motor driven chillers are used. Circulating water will have a maximum flow rate of 42,840 gpm and will increase in temperature from 85 to 100°F as it removes heat from the power plant.

A mechanical draft cooling tower using wet and dry techniques will remove the heat from the circulating water and reduce the temperature of the diesels' cooling water. Air to the cooling tower will follow two separate paths. One will be through the plant to serve as ventilation and the other will be to the cooling tower intake plenum through acoustically treated intakes. The air will become saturated while passing through the tower fill thus cooling the circulating water. It will then flow across coils carrying the diesels' cooling water and reduce the water temperature from 165 to 150°F. This will increase the air temperature to such a degree that no visible vapor plume will be produced. A diagram of this cooling tower is shown in Figure 3.5-4.

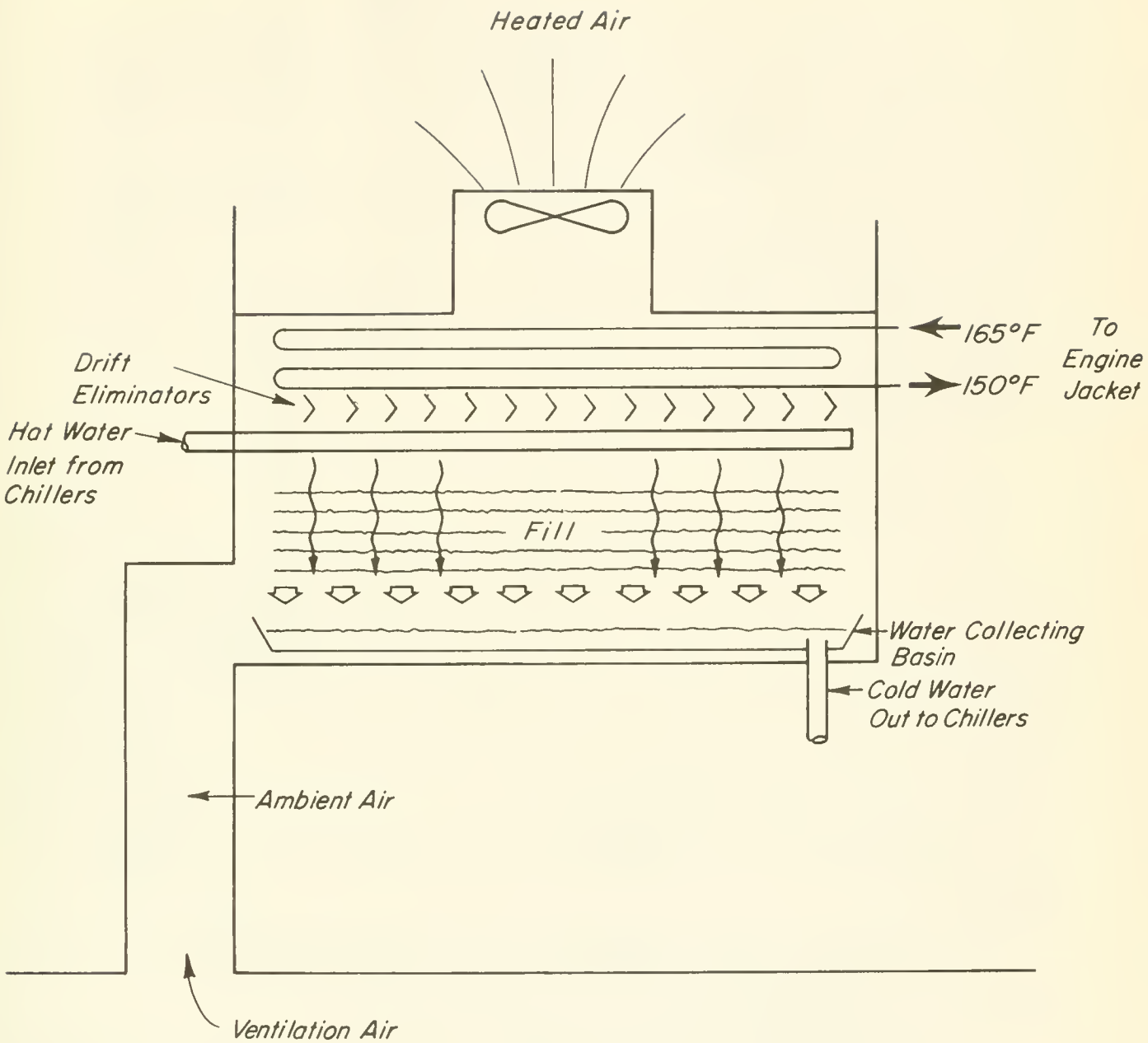

Figure 3.5-4 Schematic Diagram of the Cooling Tower

Based on a design of four cells, each cell will be approximately 50 ft by 50 ft and have an air flow of approximately 1,100,000 cfm with an exit velocity of about 20 fps. Peak circulating water flow will be approximately 42,840 gpm and peak evaporative losses will be approximately 650 gpm during the summer months. Blowdown will be a maximum of 150 gpm and drift loss will not exceed 0.1% of the circulating water flow. The tower will be operated so that the concentration factor of chemicals in the circulating water will be about 5. The physical design of the cooling tower is still being evaluated in order to provide a structure that is as aesthetically pleasing as possible while serving the operating requirements of the plant. It is planned that the tower structure will be sized for the future expansion, but only the sections necessary for the proposed project will be operated.

Flue Gas System

The flue gas system is designed to minimize potential for air contamination and to recover as much heat as possible from the combustion processes. Diesel exhaust will pass through heat recovery boilers and then into the steam boilers. Flue gases from the refuse incinerators will also flow to the steam boilers where any incineration odors will be eliminated. At full design load, the plant will have a total flue gas rate of approximately 1,000,000 lb/hr from the steam boilers.

Air for the combustion equipment will be drawn from within the power plant and air will enter the power plant through sound attenuating intakes.

The smoke stack will be 300 feet in height with a single flue. The stack will be approximately 20 feet in outside diameter and will be sized to maintain an exit velocity of about 60 fps at peak loads.

Multicyclone type dust collectors will be installed after the refuse incinerators to collect flyash. Collected material will then be recycled to the incinerator for more complete combustion. Multitube cyclone particulate collectors will be installed after the steam boilers to limit the emission of particulate matter. Collected material from this equipment and bottom ash from the incinerator will be stored in a dinosaur dumpster for removal by a disposal contractor. A diagram of the flue gas system is shown in Figure 3.5-5.

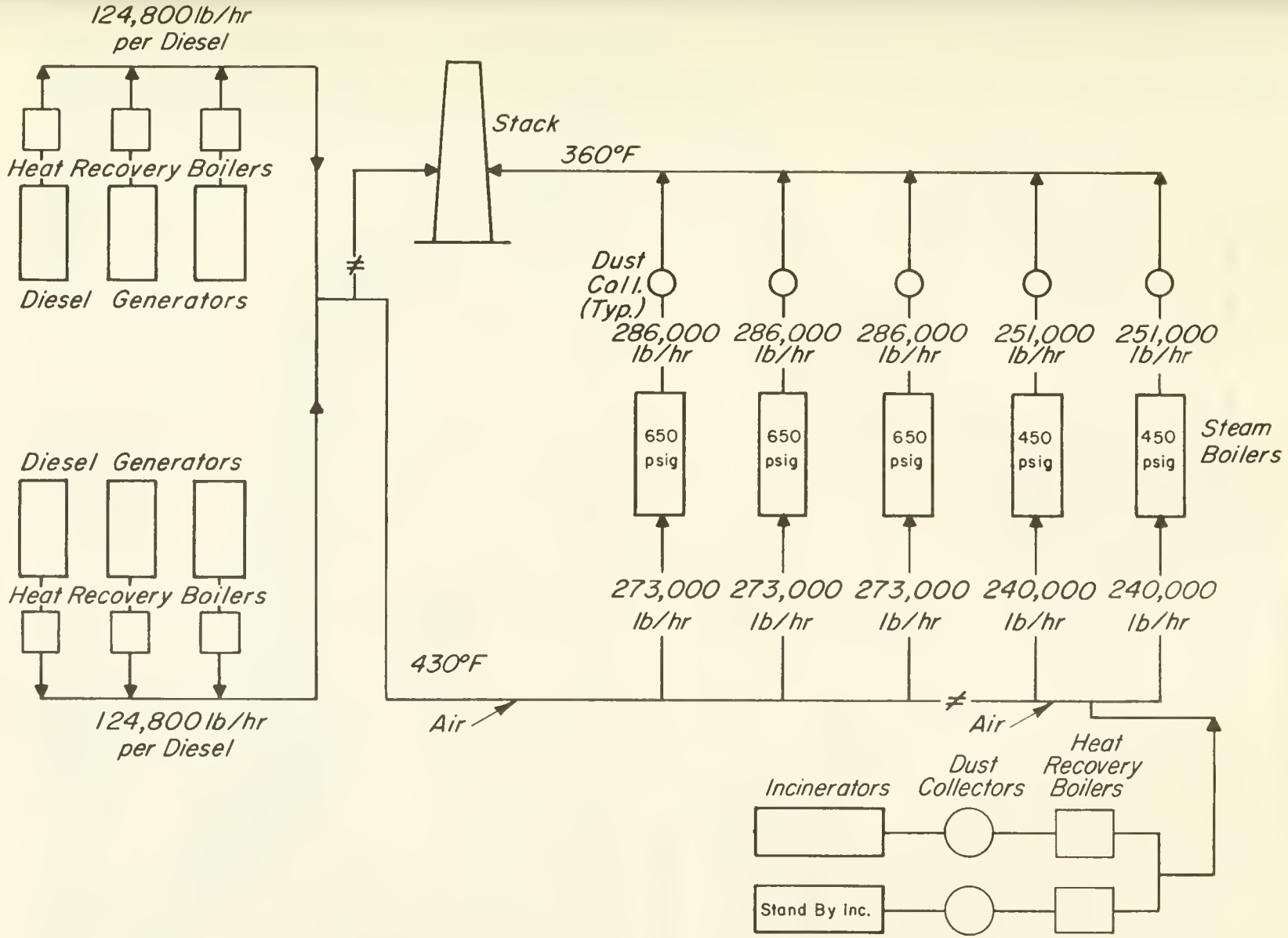

Figure 3.5-5 Schematic Diagram of the Flue Gas System

Water Use and Liquid Waste System

When the energy plant is operational, the main water requirements will be for cooling tower, boiler and condensate makeup, service water and sanitation. Water used will come from the City of Boston and discharges will go into the city sanitary sewer system. Maximum intake water requirements of the power plant are about 900 gpm and maximum discharge rate will be about 200 gpm. Average water use will be about 225 gpm and the average discharge will be about 25 gpm.

An important feature of the total energy plant is that all uncontaminated steam will be recycled thereby reducing water consumption compared to district steam supplied by Boston Edison. Steam losses will occur in autoclaves, sterilization and similar equipment.

Yard, rooftop and interior drainage will discharge into the city storm water sewer svstem. Interior drainage will be held by a stop valve until any oil in the drains is collected.

Fuel Oil System

Underground concrete tanks are being designed to hold about approximately 1,100,000 gallons of No. 6 fuel which will be a 21 day supply during average load conditions. Because of the viscosity characteristics of the oil, the tanks and fuel lines will be heated with steam to maintain the oil in the proper fluid state. The oil tanks, oil lines and unloading area will be designed in compliance with all applicable codes and regulations, in order to minimize the potential of an oil spill and to control any oil if it should spill. Fiberglass tanks within a concrete vault will store 25,000 gallons of No. 2 fuel oil and 25,000 gallons of lube oil.

Distribution System

The distribution of electricity, steam and chilled water and the reception of solid waste will be through tunnels connecting the cooperating institutions and will be extensions of the existing system. These will be 11 x 13 foot tunnels which will allow any servicing to be done from within. Final routing has not been finalized at this time but the tentative routing is as shown in Figure 3.5-6. The exact route

Figure 3.5-6 Routes of The Distribution Tunnel

will depend on the location of underground obstructions and minimizing nuisances during construction. The only major street crossing will be Longwood Avenue to reach Beth Israel Hospital. Other streets that will be involved are within the hospital area.

There will also be buried pipes from the energy plant to the Mission Park Housing Development to be built south of the plant. The services that will be provided include hot water and incineration but the extent of the necessary pipeline, size, depth and route have not been finalized at this time.

Future Expansion

It is anticipated that future needs of the medical area institutions will require increased production of utilities by the total energy plant. Thus, the plant is being designed to allow for the addition of four diesel generators, two steam boilers, three chilled water units and one steam turbine generator. Since these additions will be permitted separately from the facility as proposed, they and any associated environmental impacts will be discussed in more detail in future documents.

4. DESCRIPTION OF THE ENVIRONMENT OF THE AREA LIKELY TO BE AFFECTED BY THE PROPOSED PROJECT

This section describes the environmental conditions of the area that could be influenced by the construction and operation of the project. It is presented so that the project can be evaluated in the context of its setting. The project area is considered to be bounded by the Riverway, Huntington Avenue, the Fenway and Ruggles Street.

4.1 Air Quality

The discussion of air contaminants in this report has been limited to those for which state and federal limits of ambient concentrations have been established. These include sulfur dioxide (SO_2), total suspended particulates (TSP), nitrogen oxides (NO_X), carbon monoxide (CO), hydrocarbons (HC), and photochemical oxidants (O_X). National Air Quality Standards for these contaminants are presented in Table 4.1-1. These standards have also been adopted by the State of Massachusetts. The basis for determining the existing level of air quality is monitoring data available from the Massachusetts Bureau of Air Quality Control and the provisions of the federally approved Massachusetts air quality implementation plan.

Sulfur Dioxide

Since 1973, SO_2 concentrations measured in the Boston Metropolitan area by the Massachusetts Air Surveillance Network, MASN, have been consistently below the air quality standards. Daily, monthly and annual concentrations collected at the eight monitoring locations closest to the site for the period of April 1973 through March 1974 are presented in Table 4.1-2.

This table shows that the highest annual concentration of SO_2 was 0.012 ppm measured at Vassar Street in Cambridge. The maximum daily concentration was 0.041 ppm measured at Kenmore Square. These maximum measurements are below the respective air quality standards of 0.03 ppm and 0.14 ppm for annual and daily periods.

Three hour concentrations are not presently available from the MASN. However, Environmental Research & Technology has been collecting

TABLE 4.1-1

FEDERAL AND MASSACHUSETTS AMBIENT AIR QUALITY STANDARDS[1]

Contaminant	Duration of Indicated Concentration	Primary Standard Average Concentration		Secondary Standard Average Concentration		N.B.
		ugm/M^3	ppm	ugm/M^3	ppm	
Sulfur Oxides (SO_2)	Year	80	0.03	None	None	Arithmetic Mean
	Day	365	0.14	None	None	Maximum
	3 Hour	None	None	1,300	0.5	Maximum
	.1 Hour	None	None	None	None	--
Total Suspended Particulates (TSP)	Year	75	-	(60a)	-	Geometric Mean
	Day	260	-	150	-	Maximum
Carbon Monoxide (CO)	8 Hour	10 (milligrams)	9	Same	Same	Maximum
	1 Hour	40 (milligrams)	35	Same	Same	Maximum
Photochemcial Oxidants (03)	1 Hour	160	0.08	Same	Same	Maximum
Hydrocarbons (Non-methane)	3 Hour	160	0.24	Same	Same	Maximum Between 6 and 9 A.M.
Nitrogen Oxides (NO2)	Year	100	0.05	Same	Same	Arithmetic Mean

Annual standards are never to be exceeded. Other standards may be exceeded once per year.

In Massachusetts the primary standards for carbon monoxide, photochemical oxidants and hydrocarbons and the secondary standards for particulates are to be met by 1977. Secondary standards for SO_2 are to be met by 1975 and primary standards for SO_2 and NO_2 are to be met now.

a) A guide to be used in assessing implementation plans to achieve the 24-hour standard.

b) A guide to achieve oxidant standards.

TABLE 4.1-2

BOSTON APCD SULFUR DIOXIDE DATA (ppb)

Station	Brookline High		Harvard Herbaria, Cambridge		Science Park, Cambridge	
	324.8 UTMX 4688.5 UTMY		326.8 UTMX 4694.8 UTMY		329.1 UTMX 4692.3 UTMY	
Month	Peak Daily	Monthly Average	Month	Peak Daily	Monthly Average	Month	Peak Daily	Monthly Average
April 73	7	6	April 73	2	2	April 7		
May	10	4	May	-		May		-
June	2	2	June	2	2	June	-	-
July	4	2	July	-	-	July	1	1
Aug	7	7	Aug	5	5	Aug	3	2
Sept	4	3	Sept	6	6	Sept	10	5
Oct	12	6	Oct	8	6	Oct	16	9
Nov	30	11	Nov	32	18	Nov	32	11
Dec	21	9	Dec	10	6	Dec	12	7
Jan 74	28	7	Jan 74	33	14	Jan 74	37	16
Feb	31	16	Feb	14	7	Feb	48	24
Mar	5	2	Mar	11	5	Mar	14	10
Annual Average		6	Annual Average		9	Annual Average		11

UTMX = Universal Tranverse Mercator-Abcissa

UTMY = Universal Tranverse Mercator-ordinate

TABLE 4.1-2 (Cont'd)

BOSTON APCD SULFUR DIOXIDE DATA (ppb)

Vassar Street, Cambridge

326.15 UTMX 1693.3 UTMY

Month	Peak Daily	Monthly Average
April 73	23	13
May	21	12
June	18	8
July	14	7
Aug	16	9
Sept	30	16
Oct	24	12
Nov	36	15
Dec	31	13
Jan 74	29	15
Feb	27	13
Mar	15	8
Annual Average		12

TABLE 4.1-2 (Cont'd)

BOSTON APCD SULFUR DIOXIDE DATA (ppb)

Station: South Bay, Boston

329.4 UTMX 4688.6 UTMY

Month	Peak Daily	Monthly Average
April 73	2	2
May	19	10
June	5	3
July	3	2
Aug	6	3
Sept	9	4
Oct	16	10
Nov	31	13
Dec	8	4
Jan 74	22	14
Feb	32	14
Mar	6	3
Annual Average		7

E. Central Sq., Boston

332.1 UTMX 4694.4 UTMY

Month	Peak Daily	Monthly Average
April 73	12	7
May	15	8
June	5	3
July	4	2
Aug	3	2
Sept	3	2
Oct	7	3
Nov	-	-
Dec	13	6
Jan 74	9	4
Feb	25	12
Mar	5	2
Annual Average		6

TABLE 4.1-2 (Cont'd)

BOSTON APCD SULFUR DIOXIDE DATA (ppb)

Month	JFK Federal Building, Boston 330.3 UTMX 4691.9 UTMY Peak Daily	Monthly Average	Kenmore Square, Boston 327.3 UTMX 4690.6 UTMY Peak Daily	Monthly Average
April 73	22	14	4	2
May	9	6	7	3
June	3	2	12	6
July	4	3	6	1
Aug	5	4	6	2
Sept	14	10	13	7
Oct	14	-	24	13
Nov	37	14	32	14
Dec	14	5	31	10
Jan 74	27	17	24	11
Feb	36	36	41	15
Mar	11	11	18	9
Annual Average		9	Annual Average	9

TABLE 4.1-3

BOSTON APCD PARTICULATE DATA ($\mu g/m^3$)

Month	Brookline High School 324.8 UTMX 4688.8 UTMY Peak Daily	Monthly Average	Harvard Herbaria, Cambridge 326.8 UTMX 4694.8 UTMY Peak Daily	Monthly Average	Science Park, Cambridge 329.4 UTMX 4692.3 UTMY Peak Daily	Monthly Average
April 73	62	49	-	-	-	-
May	53	37	-	-	78	78
June	40	40	-	-	-	-
July	96	56	-	-	52	52
Aug	102	67	-	-	83	66
Sept	42	18	73	73	83	61
Oct	74	45	70	46	88	54
Nov	37	31	68	48	79	50
Dec	58	58	35	27	56	45
Jan 74	64	38	90	42	124	60
Feb	45	37	67	40	109	63
Mar	36	25	62	37	74	52
Annual Average		40	Annual Average	43	Annual Average	62

TABLE 4.1-3 (Cont'd)

BOSTON APCD PARTICULATE DATA ($\mu g/m^3$)

Month	Peak Daily	Monthly Average	Month	Peak Daily	Monthly Average
April 73	-	-	April 73	-	-
May	-	-	May	-	-
June	-	-	June	-	-
July	75	71	July	68	63
Aug	105	82	Aug	96	72
Sept	92	55	Sept	56	50
Oct	109	71	Oct	260	260
Nov	152	87	Nov	-	-
Dec	61	39	Dec	106	38
Jan 74	90	70	Jan 74	112	72
Feb	108	62	Feb	80	54
Mar	79	59	Mar	79	32
	Annual Average	65		Annual Average	52

TABLE 4.1-3 (Cont'd)

BOSTON APCD PARTICULATE DATA ($\mu g/m^3$)

	JFK Federal Building 330.3 UTMX 4691.9 UTMY			Kenmore Square 327.3 UTMX 4690.6 UTMY	
Month	Peak Daily	Monthly Average	Month	Peak Daily	Monthly Average
April 73	-	-	April 73	-	-
May	-	-	May	-	-
June	-	-	June	86	81
July	69	64	July	126	98
Aug	147	94	Aug	122	87
Sept	95	95	Sept	121	108
Oct	88	59	Oct	114	88
Nov	70	44	Nov	10S	79
Dec	49	36	Dec	12S	73
Jan 74	86	45	Jan 74	200	74
Feb	73	53	Feb	146	88
Mar	59	46	Mar	116	92
	Annual Average	56		Annual Average	84

SO_2 data from the Vassar Street monitoring location and results indicate that maximum 3 hour values are approximately 10% of the 0.5 ppm standard.

The SO_2 concentrations measured show a definite trend of higher levels during the winter months. This is expected in urban areas and reflects increased emissions from space heating requirements.

Total Suspended Particulates

Particulate levels throughout the Boston area are high, and levels set by the primary annual and secondary daily standards have been exceeded. Data collected by the state at seven locations close to the site for the period of April 1973 through March 1974 are presented in Table 4.1-3. The maximum annual concentration of 84 $\mu g/m^3$ was measured at Kenmore Square and the maximum daily concentration of 260 $\mu g/m^3$ was measured at Central Square in East Boston. These are in excess of the 60 $\mu g/m^3$ and 150 $\mu g/m^3$ annual and daily levels of the secondary air quality standards. The level set by the secondary daily standard was exceeded at Kenmore Square, Central Square and South Boston.

Particulate levels have not shown the seasonal trend that is evident for SO_2. This indicates that particulate levels are not directly related to space heating, but are instead due to many urban activities such as incineration, construction and traffic.

Since the monitoring locations at Brookline High School and Kenmore Square are approximately equidistant from the site and are on opposite sides of the site, the site particulate levels are probably a combination of the values measured at those locations. The Brookline High School monitor showed no violations of particulate standards.

Nitrogen Dioxide

The NO_2 situation within the Metropolitan Boston area cannot be accurately assessed at this time. The measurements of NO_2 have been made by the Massachusetts Department of Public Health, but are based on the Jacob-Hocheiser method of analysis. This method is now considered unreliable by the Environmental Protection Agency[2] because it overestimates NO_2 concentrations at levels below 0.07 ppm and underestimates at levels above. The fact that errors can reach a factor of 2 or 3 at

either end of the measurement range makes it impossible to draw meaningful comparisons between measured values and the 0.05 ppm annual NO_2 air quality standard. The Boston traffic control plan and emission limitations for NO_2 have been planned to maintain NO_2 levels below air quality standards even though there is no EPA control strategy promulgated specifically for meeting the NO_2 standard in Boston. In the Federal Register of May 8, 1974, the EPA indicated that Chicago and Los Angeles were the only cities with a critical NO_2 problem.[3]

Carbon Monoxide

The CO monitor nearest to the project site is located in Kenmore Square. At this location the 8-hour standard of 9 ppm has been frequently exceeded over the past few years; the 1-hour standard of 35 ppm has not been exceeded. In the first ten months of 1974, the second highest 8-hour and 1-hour concentrations were 12.8 ppm and 18 ppm. (The second highest values were used since the limit set by the standard can be exceeded once per year.)

There are no ambient measurements of CO available for the project area. Therefore, an estimate was made based on the ratio of emission rates between Kenmore Square and the project area and the values measured at Kenmore Square. This emission density approach is usually applied to estimating long-term averages rather than short-term averages. It is usually based upon the use of a monitor that is removed as far as possible from the influence of local sources and is, as a result, more representative of concentrations over some larger area and the longer averaging time is necessary to assume that the pollutant is uniformly mixed with the air over that area.

However, since the Kenmore Square monitor is only a short distance above an intersection of several heavily traveled streets it may serve as a reference monitor for short-term concentrations. Therefore, the following equation has been used:

$$CO_{(site)} = CO_{(monitor)} \times VE_{(site)}/VE_{(monitor)}$$

where

$CO_{(site)}$ = concentrations of CO near the project

$CO_{(monitor)}$ = concentrations of CO at the Kenmore Square monitor

$VE_{(site)}$ = maximum vehicular CO emission rate during the time period of interest from Brookline Avenue

$VE_{(monitor)}$ = maximum vehicular emission rate during the time period of interest from the streets adjacent to the Kenmore Square monitor.

Since the mixture of vehicle ages and types and average speed are similar for Kenmore Square and Brookline Avenue, the vehicular emissions can be replaced by the ratio of traffic counts at the two areas for 1-hour and 8-hour peak traffic conditions. Traffic counts on Brookline Avenue at the Longwood Avenue intersection and at Kenmore Square acquired in 1974 by the Boston City Traffic Department result in an emission ratio of 0.48.

CO concentrations at the site are, therefore, calculated as follows:

$$CO_{(site - 1\ hour)} = 18\ ppm \times \frac{0.48}{} = 8.6\ ppm$$

$$CO_{(site - 8\ hour)} = 12.8\ ppm \times \frac{0.48}{} = 6.1\ ppm$$

These values are below the 1-hour and 8-hour standards of 35 ppm and 9 ppm respectively.

Hydrocarbons and Photochemical Oxidants

Hydrocarbons (HC) do not of themselves constitute a health hazard, but they are the chemical precursors to photochemical oxidants such as ozone (O_3) which do constitute a hazard. Therefore, attention is directed toward photochemical oxidants.

The 1-hour oxidant standard of 0.08 ppm was violated 13 times at the Kenmore Square monitor from January 1974 to June 1974, with the peak, 1-hour reading equal to 0.162 ppm. The 1-hour oxidant standard was violated at Wellington Circle, Medford, the worst Metropolitan Boston station, 115 times in 1973 with a peak hour of 0.200 ppm; but

this monitoring station is somewhat remote from the site of the proposed project (>3 miles). The air quality at the proposed project site is likely to be better with respect to hydrocarbon and photochemical oxidant levels than Kenmore Square because motor vehicle activity is less in the vicinity of the site than at Kenmore Square.

References for 4.1 Air Quality

1. National Primary and Secondary Air Quality Standards, Federal Register Vol. 38, No. 178 - Friday, September 14, 1973.

2. Reference Method for Determination of Nitrogen Dioxide, Federal Register Vol. 38, No. 110 - Friday, June 8, 1973.

3. Approval and Promulgation of Implementation Plans, Federal Register Vol. 39, No. 90 - Wednesday, May 8, 1974.

4.2 Hydrology

This section on hydrology is presented since the proposed project may influence the Muddy River and the Charles River Watershed due to a change in surface runoff and it is necessary to understand the hydrology before an impact can be evaluated.

Climatology

Since all water moving in the land-bound portion of the hydrologic cycle derives either directly or indirectly from precipitation, the following section defines climatologic conditions for the project area, with particular consideration given to temperature, precipitation, and wind.

The climate of the lower Charles River Watershed is variable, generally characterized by frequent but usually short periods of precipitation. Lying within the path of "prevailing westerlies," the area is subject to cyclonic disturbances that traverse the country from the west or southwest. On occasion, coastal storms of tropical origin travel up the Atlantic seaboard. Although seldom severe in nature, these storms do occasionally attain hurricane intensity, most frequently in the late summer and early autumn months.

Precipitation, temperature, and snowfall data for Boston at Logan Airport in East Boston, which because of its close proximity is considered representative of the site area, are presented in Table 4.2-1. Recurrence intervals associated with various storm intensities and durations are presented in Figure 4.2-1.

Temperature

The mean annual air temperature of the Lower Charles River Watershed is approximately 50°F. Monthly averages range from 67°F to 72°F in July and August to 25°F to 29°F in January and February. Temperature extremes range from occasional highs slightly in excess of 100°F to infrequent lows below -20°F.

Precipitation

The mean annual precipitation of the Lower Charles River Watershed is approximately 43 inches, with a generally uniform monthly distribution. At any one recording station within the lower watershed area, the range between maximum and minimum values of average monthly rainfall is only about 1 inch.

Annual snowfall in the Metropolitan vicinity varies from approximately 42 inches at coastal Boston to 60 inches at the Blue Hills Observatory, located 12 miles south of Boston at elevation 640 feet mean sea level. Snow cover attains a maximum depth in March, with the water content often exceeding 2 inches.

Wind

On an annual basis the most frequent wind direction is southwest. During the winter and spring months, the most frequent directions are northwest and west northwest. Wind speeds range from 8 to 18 mph approximately 70% of the time, with the strongest winds blowing from the northeast.

Watershed Description

The following descriptions of the watershed and occurrence of flooding is presented to explain the mechanism of floods and severity of past

TABLE 4.2-1

MONTHLY PRECIPITATION, TEMPERATURE, AND SNOW DATA

BOSTON, MASSACHUSETTS

Month	Precipitation (inches) 96 Years of Record Mean	Max.	Min.	Temperature (°F) 96 Years of Record Mean	Max.	Min.	Snow (inches) 32 Years of Record
JAN	3.65	9.54	0.92	29.1	72	-13	12.7
FEB	3.34	7.04	0.45	29.2	68	-18	11.4
MAR	3.81	11.00	T	34.6	86	- 8	8.3
APR	3.58	9.14	0.93	47.2	91	11	0.8
MAY	3.21	13.38	0.25	57.9	97	31	T
JUNE	3.13	9.13	0.27	67.3	100	41	T
JULY	3.22	11.69	0.52	72.3	104	50	T
AUG	3.62	17.09	0.39	71.4	101	46	T
SEPT	3.21	10.94	0.21	64.3	102	34	0
OCT	3.28	8.84	0.06	55.0	90	25	T
NOV	3.79	11.03	0.59	44.5	83	- 2	1.3
DEC	3.45	8.49	0.66	32.8	69	-17	7.2
ANNUAL	41.29	17.09	T	50.7	104	-18	41.7

T signifies trace amounts too small to measure.

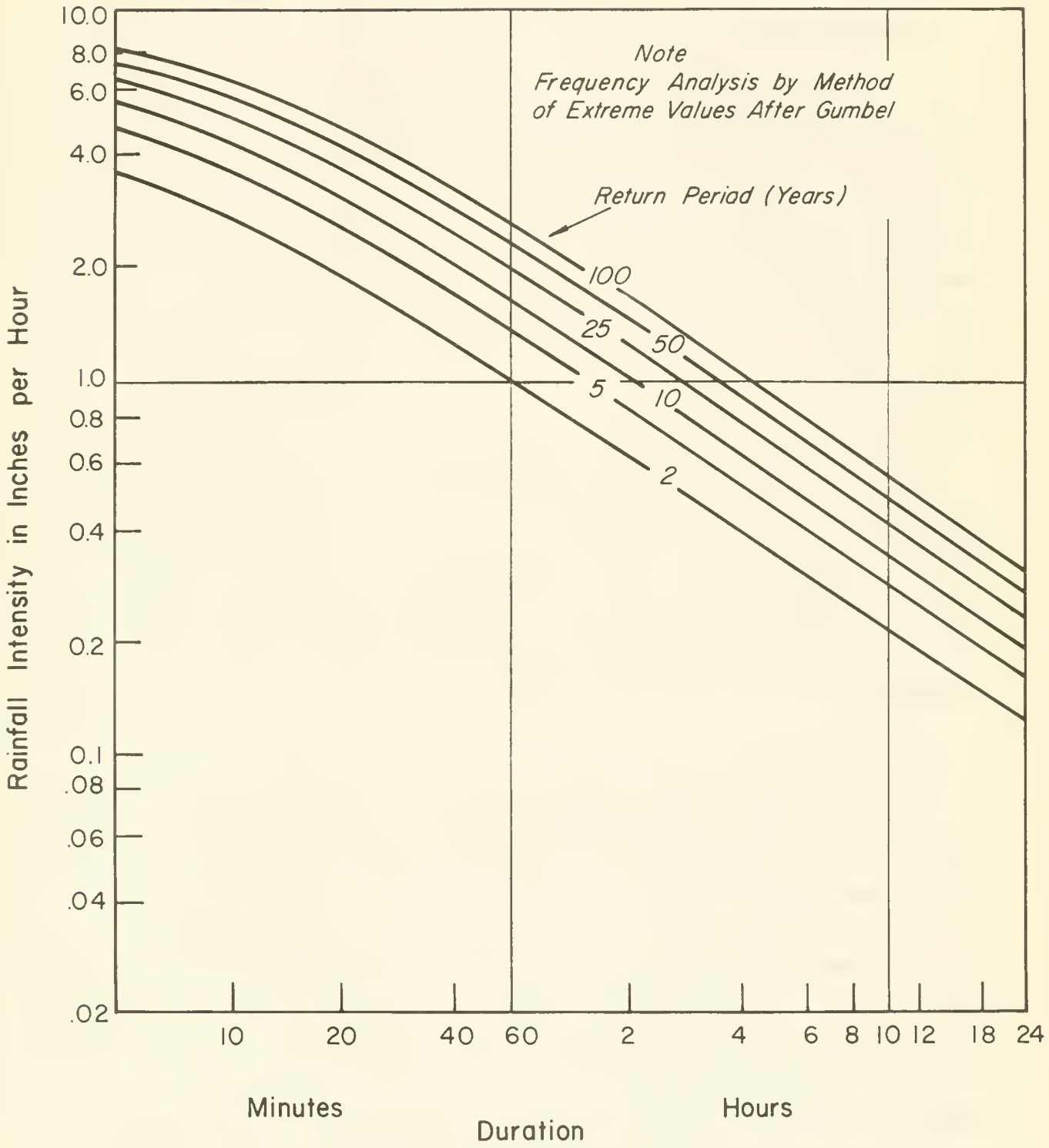

Figure 4.2-1 Rainfall Intensity-Duration-Frequency Curves, Boston, Massachusetts

floods. The site of the power plant has never experienced flood conditions.

Charles River

The Charles River Watershed is located in Eastern Massachusetts bordering on watersheds of the Mystic, Merrimack, Blackstone, Taunton, and Neponset Rivers. With an area of approximately 307 square miles, the watershed is hourglass in shape with a length in the southwest-northeast direction of 31 miles and widths of 15, 6 and 16 miles in a northwest-southeast direction. Elevations vary from 586 feet above mean sea level (msl) along the southwesterly edge of the watershed in Hopkinton to below 10 feet msl along the lower 3 miles of the Charles River. Within the basin there are 33 lakes and ponds having a combined surface area of over 2,500 acres, not including ponded areas along the river itself.

The Lower Charles River Watershed extends from the Moody Street dam in Waltham for approximately 12 miles to its mouth at tidewater below the Charles River dam. This subdivision of the total watershed covers an area of 58 square miles. With the exception of the Muddy River, Stony Brook, and Beaver Brook, only minor tributaries enter the main stream. Together these three tributaries drain nearly 60 percent of the total drainage area of the Lower Charles River.

Muddy River

Muddy River, along which the project area is located, rises in Jamaica Pond, in the west-central part of Boston, at an elevation of approximately 60 feet msl and flows northeasterly about 2 miles through a series of small ponds, conduits, and channels discharging into Back Bay Fens through a conduit under Park Drive. At this location, the drainage area is 6.1 square miles. The river drops 56 feet in the first 2,000 feet below Jamaica Pond. The remaining length of the river is very sluggish and during normal flows remains at a nearly constant level of 3 feet msl. The dry weather flow continues northeasterly about 200 feet to a conduit under Brookline Avenue and Deerfield Street and empties into the Charles River Basin about 2.5 miles above the Charles River dam.

Flood Conditions

Flooding of the Charles River and its tributaries has been a serious problem in recent years. Floods of major proportions have occurred in March 1936, July 1938, September 1954, August 1955, and March 1968. A brief description of each is presented in the following paragraphs.

March 1936 flood - This flood, marked by two distinct peaks spaced about 6 days apart, resulted from a combination of runoff from melting snow and heavy rainfall from two major storms over the watershed. Rainfall amounts for the combined storms ranged from 4.5 inches in the lower watershed to more than 7 inches in the upper areas. On the Charles River a peak discharge of 3,170 cfs was recorded at the USGS gaging station. The March 1936 flood produced a maximum Basin elevation of 3.7 feet msl or 1.3 feet above normal.

July 1938 flood - During a 7-day period, from 18 to 24 July, torrential rains fell throughout the Charles River watershed resulting in near record flood levels along the main stem. A total of 9.2 inches of rainfall was measured at Brookline, Massachusetts. In the upper portion of the watershed at Milford, 12.3 inches of rain was recorded. Rainfall amounts in the lower watershed ranged from 4.0 inches at Boston to 7.7 inches at Framingham. The July 1938 flood resulted in the basin level rising to approximately 1 foot above normal.

September 1954 flood - The storm which accompanied hurricane "Carol" on 11-12 September 1954 produced the third highest stage in the Charles River Basin. An elevation of 4.93 feet msl was recorded at the Charles River dam. A total storm rainfall of 6.32 inches was measured by the U.S. Weather Bureau at Boston. The maximum tide associated with hurricane "Carol" was 6.4 feet msl.

August 1955 flood - This flood, one of the greatest of record on the Charles River, resulted from record rainfall accompanying hurricane "Diane" falling on ground previously saturated by the precipitation of hurricane "Connie", which occurred only a week earlier. Hurricane "Connie", 11-15 August, caused rainfall varying from 4 to 6 inches over southern New England and ended a period of drought. A week later, on 17-20 August, hurricane "Diane" brought rainfall from 16 to 20 inches over Massachusetts. Rainfall totals for hurricane "Diane" at Boston and Chestnut Hill were 12.5 and

13 inches, respectively. Abnormally high tides in Boston Harbor, combined with high local runoff resulting from very intense rainfall, produced a record Basin elevation of 6.9 feet msl, 4.5 feet above the normal level.

March 1968 flood - Heavy rainfall occurring over southern New England on 17-18 March resulted in the second largest flood of record in the lower reaches of the Charles River. Highest amounts of precipitation fell in the area just southwest of Boston with 7.7 inches measured at Blue Hills. The Charles River Basin rose 2.85 feet above normal and inundated a section of Storrow Drive.

The flood problem in the Charles River Basin and surrounding low area in Cambridge and the Back Bay section of Boston is caused basically by the difference in the established normal water level in the Basin and high tide in the harbor. The Basin level is 2.5 feet below mean high water in the harbor which necessitates storing the flow into the Basin for a period of 4 to 6 hours during every high tide cycle. This can be accomplished without difficulty during normal flows and even minor floods. However, major storms and high rates of inflow during the high tide cycle, inadequate discharge capacity of the sluice gates during low tides, urban expansion, and encroachments affecting the storage capacity of the Basin have all combined to produce progressively higher uncontrollable Basin elevations.

The major floods of record have been analyzed by the Corps of Engineers to determine their hydrologic development, including the tributary components contributing to the crests. Basic data for this analysis include Basin elevations at the Metropolitan District Commission (MDC) Charles River dam, discharge records at the USGS gaging station at Waltham, and rainfall records maintained by the U.S. Weather Bureau at Cambridge and Logan Airport in East Boston. These records are continuous throughout the several flood periods studied.

Records of concurrent harbor and Basin levels have been maintained at the MDC dam since 1910. These records include operational data for the sluice and lock gates, which are used to control the Basin level. Discharge through these gates depends on the differential head between the Basin and harbor. With the Basin at its normal elevation of 2.4 feet msl, each gate can discharge about 700 cfs with the harbor at msl or lower.

In anticipation of a serious storm, the Basin is predrawn by the MDC. Elevation 0.9 feet msl is the lowest drawdown permitted, and 1.4 feet msl is the usual target.

Inflow to the Basin is the summation of three items. (a) flow at Waltham, (b) rainfall directly on the water surface of the Charles River Basin, and (c) local inflow from adjacent drainage areas.

High peak inflows are experienced within an hour following an intense storm, indicating the importance of local drainage to the Basin. Rapid flood runoff from the lower 56 square miles of the Charles River Watershed, between Moody Street dam and the existing Charles River dam, is the principal cause of the flood problems during recent record floods. The rapid runoff is a response to the urban growth that has taken place in the immediate area. The creation of the Basin in 1910 has encouraged millions of dollars worth of construction at low elevations in Boston and Cambridge, and almost all available marginal lands along the Basin have been utilized. Increased roof and pavement areas and extended storm drainage systems have speeded the peak concentrated runoffs into the lower Charles River and its tributaries.

The relative contributions from the lower and upper watersheds to the peak rate of inflow, and the volume of inflow producing the highest elevation in the Basin are shown in Table 4.2-2.

The flooding of lowlands in the area of Back Bay Fens and along Muddy River presents a secondary flood problem in the lower Charles watershed. The problem is caused by overflows to the Fens from Stony Brook conduit, high flows in Muddy River, and backwater from the pool of the Charles River Basin.

The record high flood stages experienced in August 1955, occurring in the channel storage pool of the Muddy River upstream of Park Drive, were produced by a combination of the following factors:

1) High stage in the Charles River Basin

2) Bridge and channel restrictions in the lower Muddy River between Boylston Street and the Basin

3) High rates of discharge probably augmented by overflow from the Stony Brook conduit

TABLE 4.2-2

EFFECT OF UPPER AND LOWER WATERSHEDS
ON BASIN ELEVATIONS DURING FLOODS

Item	FLOODS							
	1954		1955		1962		1968	
	CFS	%	CFS	%	CFS	%	CFS	%
Peak Inflow	9,600		15,000		6,000		4,800	
Upper Watershed*	900	9	1,300	9	600	10	1,800	38
Lower Watershed**	8,700	91	13,700	91	5,400	90	3,000	62
Volume of Inflow Producing Highest Elevation in Basin	3,450		6,200		2,350		1,900	
Upper Watershed*	350	10	1,120	18	280	12	825	44
Lower Watershed**	3,100	90	5,080	82	2,070	88	1,075	56
Maximum Basin Elevation MSL	4.9		6.9		4.0		5.2	

*Upstream of USGS gaging station in Waltham, Drainage Area = 251 square miles

**Downstream of USGS gaging station in Waltham, Drainage Area = 56 square miles

4) Flat gradients and insufficient channel capacity in the Fenway

5) Inadequate culverts under the Sears Roebuck parking area

There are four principal drainage outlets in Brookline discharging into Muddy River, namely Village Brook, Tannery Brook, Longwood Avenue and Chestnut Street. Collectively, these drains have a discharge capacity of about 1,700 cfs, equivalent to a runoff of 0.66 inch per hour. Due to different times of concentration in the various drainage systems, peak flows in the drains may not coincide and hence may not be additive.

The Corps of Engineers has made an analysis of two significant floods on the Muddy River. These occurred in August 1955 and October 1962. Pertinent features of these floods are listed below.

Flood	Rainfall (inches)	Runoff (inches)	Inflow (cfs)	Outflow (cfs)	Maximum Elevation Muddy River (ft, msl)
August 1955	(24 Hours)				
	8.8	4.0	2,000	1,100	12.3
October 1962	7.0	3.5	1,100	700	11.4

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4.3 Water Quality

Urban Runoff

The principle water quality impact exerted upon the local water resources by the site area results from the quality of the urban runoff. A principal determinant of the general quality of urban runoff is the large dependence upon the automobile. The substances discharged through automobile utilization are many and complex. A partial listing of these substances includes: lead compounds, oil and grease, zinc and cadmium additives in lubricating oils, and calcium bromide (a gasoline additive). Runoff constituent concentrations obtained in two studies on residential/commercial runoff are shown in Table 4.3-1. The data indicates that the runoff analyzed in both studies exerts a very high oxygen demand, with a COD comparable to that of sewage after secondary treatment. The suspended solids concentrations are also high, and would result in a visible deterioration in the aesthetic quality of the runoff water. The nitrate-nitrite and ortho-phosphate concentrations measured in both studies indicate that urban runoff is a significant source of algal nutrients for the receiving water resources. Heavy metal loads on street surfaces for six U. S. communities were recently determined by an EPA study.[1] The results are listed in Table 4.3-2, and are given in units of lb/curb mile. The data indicates that street surfaces are a very significant source of heavy metals during storm runoff release. Storm runoff from the site which enters the off-site storm water sewer system will discharge to the Muddy River immediately north of the intersection of Brookline Avenue and the Riverway.

Muddy River

The water quality of the Muddy River is poor--both physically and aesthetically. Pockets of debris and litter are created by the poor flushing characteristics of the river. The primary sources of pollution are combined and separate storm sewers and litter disposal. A water quality sampling program for the Muddy River was recently performed by the Massachusetts Division of Water Pollution Control in 1974. The locations of the three sampling stations which characterize the quality of the Muddy River before it empties into the Back Bay Fens are depicted

TABLE 4.3-1

RUNOFF CONSTITUENT CONCENTRATIONS FOR TWO STUDY AREAS

	Residential/Commercial Site in Cincinnatti, Ohio[1]	Residential/ Commercial Site in Cleveland, Ohio[2]
COD (mg/1)	99	35
BOD_5 (mg/1)	19	15
Suspended Solids (mg/1)	210	30
Oil (mg/1)	1	--
Total Nitrogen (mg/1 as N)	2.75	3.1
Nitrate & Nitrite (mg/1 as N)	0.45	0.1
Total Coliforms (MPN/100ml)	58,000	--
Ortho-phosphate (mg/1 as P)	0.26	0.7*

*Total Phosphorous

TABLE 4.3-2

STREET HEAVY METAL LOADS[3]

	Weighted Average* (lb/curb mile)
Chromium	0.11
Copper	0.20
Zinc	0.65
Nickel	0.05
Mercury	0.073
Lead	0.57
Total Heavy Metals	1.6

*The weighted average was derived from heavy metal study programs at six selected communities.

in Figure 4.3-1. Station 1 is located at the Jamaica Pond outlet. Station 2 is located at the Leverett Pond outlet (immediately south of the intersection of Route 9 and the Riverway). Station 3 is located on the Muddy River immediately south of Park Drive. A diurnal sampling program (temperature and dissolved oxygen) for the three stations was conducted on June 18-20, 1974. The diurnal program data is given in Table 4.3-3. The large dissolved oxygen fluctuations seen at Stations 2 and 3 indicate the probable existence of a large algal population. The fluctuations are due to the diurnal cycle of respiration and photosynthesis attributed to the algal population. A water quality analysis for samples collected at the three stations on June 18 and 20, 1974, was also performed. The results are shown in Table 4.3-4. The data indicates that the water quality at the Jamaica Pond outlet is relatively good, while the two downstream stations display a significant deterioration in water quality. Large increases in BOD (Biochemical Oxygen Demand) and suspended solids concentrations occur between Stations 1 and 2. A very large increase in total phosphorous also occurs between Station 1 and the downstream stations. This large increase in phosphorous (an algal nutrient) is probably responsible for the large algal populations in evidence at Stations 2 and 3. A very large increase in total coliform concentrations also occurs between Stations 1 and 2. The Muddy River presently has the legal water quality classification of Class B. The water quality criteria for Class B are shown in Table 4.3-5. The Muddy River does not meet the criteria contained in Items 1-5, and 8 of the Class B designation (determined by ERT through review of state water quality data plus field observations). In summary, the Muddy River experiences a significant deterioration in water quality as it proceeds from Jamaica Pond to the Back Bay Fens. This deterioration is primarily due to the discharge of pollutants from combined and separate storm sewers.

The Massachusettts Department of Public Works, is planning to begin dredging of the Back Bay Fens during February, 1975. The dredging will involve that area from the Sears parking lot to the Charlesgate. The dredged material will be degrited by a cyclonic degriter, with the resulting "soupy" material being disposed of in the MDC sewer system.

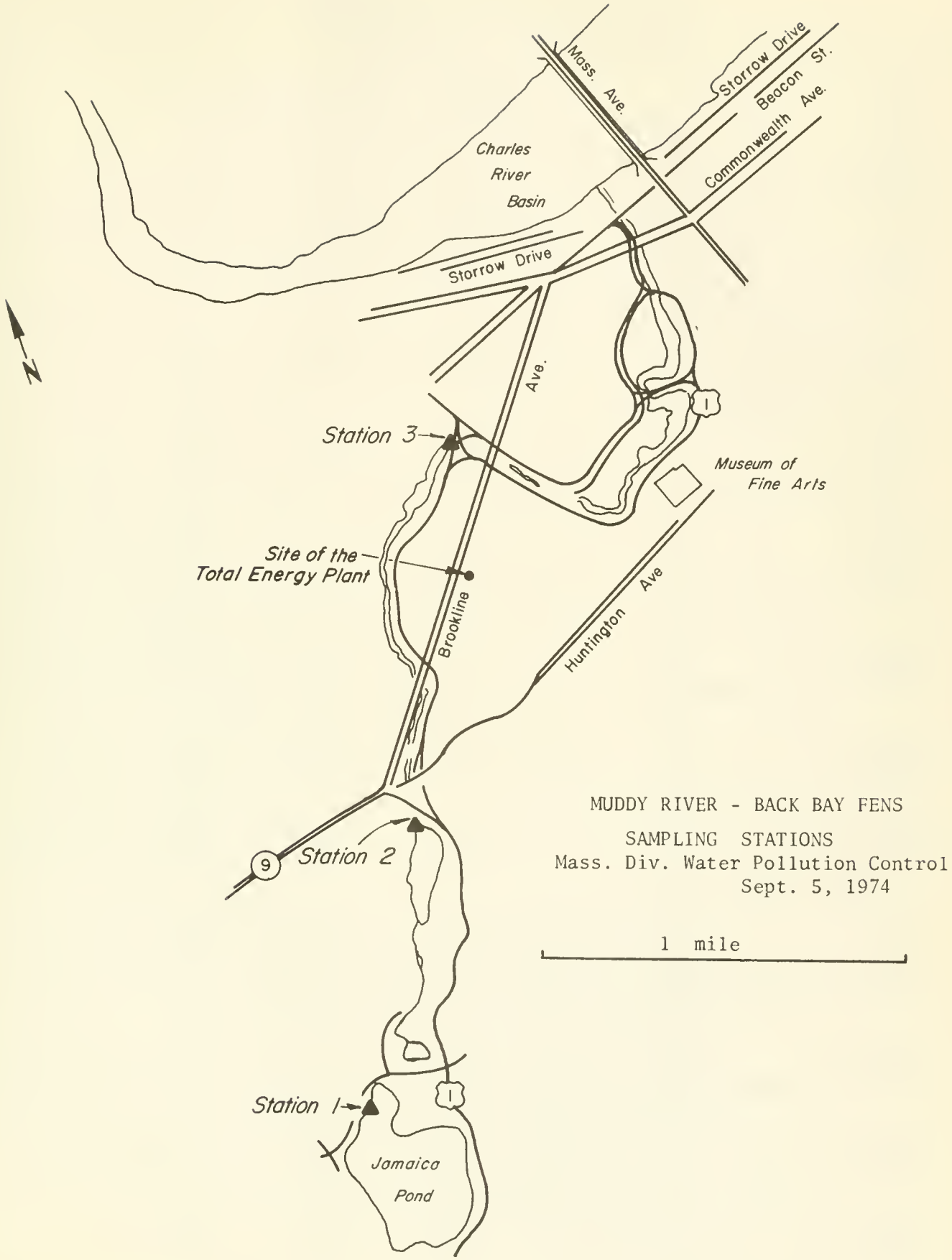

Figure 4.3-1 Muddy River Sampling Stations

TABLE 4.3-3

DIURNAL TEMPERATURE AND DISSOLVED OXYGEN DATA FOR THE MUDDY RIVER[1]

Date	Station 1	Station 2	Station 3
6/18/74			
Time	0630	0635	0620
Temp (°F)	72	71	70
Dissolved Oxygen (mg/l)	8.9	2.0	1.1
Time	1025	1030	1018
Temp (°F)	73	72	72
Dissolved Oxygen (mg/l)	9.0	5.2	1.9
Time	1417	1425	1410
Temp (°F)	74	76	75
Dissolved Oxygen (mg/l)	8.6	9.9	7.4
Time	1840	1845	1830
Temp (°F)	74	76	76
Dissolved Oxygen (mg/l)	8.4	11.1	9.9
6/19/74			
Time	0645	0649	0615
Temp (°F)	65	64	65
Dissolved Oxygen (mg/l)	8.9	6.6	2.2
Time	1014	1019	1005
Temp (°F)	71	70	70
Dissolved Oxygen (mg/l)	8.5	8.4	3.5
Time	1417	1425	1410
Temp (°F)	76	76	78
Dissolved Oxygen (mg/l)	8.7	12.7	8.4
Time	1759	1805	1750
Temp (°F)	76	76	78
Dissolved Oxygen (mg/l)	8.7	12.9	10.3
6/20/74			
Time	0623	0627	0615
Temp (°F)	64	64	65
Dissolved Oxygen (mg/l)	8.1	7.5	3.3
Time	1023	1030	1015
Temp (°F)	67	65	66
Dissolved Oxygen (mg/l)	9.0	7.6	3.4
Time	1426	1432	1416
Temp (°F)	76	76	75
Dissolved Oxygen	8.3	12.6	9.7
Time	1805	1810	1755
Temp (°F)	76	75	77
Dissolved Oxygen (mg/l)	8.3	15.3	12.0

[1]Data was collected by the Massachusetts Division of Water Pollution Control in 1974.

TABLE 4.3-4

WATER QUALITY ANALYSIS OF THE MUDDY RIVER[1]

Date of Collection	Station 1		Station 2		Station 3	
	6/18/74	6/20/74	6/18/74	6/20/74	6/18/74	6/20/74
BOD_5 (mg/l)	3.0	1.5	8.7	7.8	9.9	10
pH	7.2	7.1	7.1	7.6	7.1	7.6
Total Alkalinity (mg/l)	18	17	32	36	35	50
Suspended Solids (mg/l)	6	4.5	16	16	23	21
Ammonia-N (mg/l)	0.09	0.04	0.09	0.06	0.16	0.63
Nitrate-N (mg/l)	0.3	0.3	0.1	0.2	0.2	0.3
Total Phosphorous (mg/l)	0.05	0.03	0.34	0.15	0.35	0.32
Total Coliforms(1,000/100 ml)	8,000	2,000	160,000	70,000	180,000	60,000

[1]Data was collected and analyzed by the Massachusetts Division of Water Pollution Control (1974)

This dredging should vastly improve the visual quality of the water and also reduce the oxygen demand exerted by the existing sediments.

Lower Charles River

Storm water discharge originating from the site eventually flows from the Muddy River to the Lower Charles River. The water quality of the Lower Charles River has been severely degraded by urban runoff and combined sewer discharges. The gross bacterial contamination in evidence for the Lower Charles prohibits utilization of the river for swimming and other water-contact sports. Due to the existence of a stagnant saltwater wedge near the river's bottom, a depletion of dissolved oxygen at the bottom resulting from a lack of vertical circulation has occurred. This has resulted in the periodic release of foul odors due to anaerobic decomposition of settled organic sludge. High phosphate and nitrate concentrations have resulted in the existence of periodic algal blooms. The presence of floating petroleum products and debris severely degrades the aesthetic quality of the River. The Lower Charles River presently has the legal water quality classification of Class C. The water quality criteria for Class C are shown in Table 4.3-5. The Lower Charles River does not presently meet its water quality classification (determined by ERT through review of available water quality data plus field observations). The Metropolitan District Commission is presently conducting a construction program to reduce the frequency of combined overflows to the Charles River and to provide storm water treatment for excess storm flows from three major sewage systems. Successful completion of these construction projects should result in a significant reduction in the bacterial and organic pollution of the Charles River. Further water quality improvements in the Charles River will require a comprehensive examination of feasible control methodologies for both point and non-point source pollution.

Sewage Load and Treatment

The sewage load resulting from the present site utilization is estimated to be 21,000 gallons per day (based on 350 people at 60 gallons per person per day). The present water demand is estimated to be 22,900 gallons per day.

TABLE 4.3-5

CLASS B AND C WATER QUALITY CRITERIA[1]

Class B -- These waters are suitable for bathing and recreational purposes, water contact activities, acceptable for public water supply with treatment and disinfection, are an excellent fish and wildlife habitat, have excellent aesthetic values and are suitable for certain agricultural and industrial uses.

Item: 1. Dissolved oxygen.

Criteria: Not less than 75% of saturation during at least 16 hours of any 24 hour period and not less than 5 mg/l at any time. For cold water streams the dissolved oxygen concentration shall not be less than 6 mg/l. For seasonal cold water streams the dissolved oxygen concentration shall not be less than 6 mg/l during the season.

Items: 2. Sludge deposits-solid refuse-floating solids-oil-grease-scum.

Criteria: None other than of natural origin or those amounts which may result from the discharge from waste treatment facilities providing appropriate treatment. For oil and grease of petroleum origin the maximum allowable concentration is 15 mg/l.

Items: 3. Color and turbidity.

Criteria: None in such concentrations that would impair any uses specifically assigned to this class.

Item: 4. Coliform bacteria per 100 ml.

Criteria: Not to exceed an average value of 1000 nor more than 1000 in 20% of the samples.

Items: 5. Taste and odor.

Criteria: None in such concentrations that would impair any uses specifically assigned to this class and none that would cause taste and odor in edible fish.

Item: 6. pH.

Criteria: 6.5--8.0.

Item: 7. Allowable temperature increase.

Criteria: None except where the increase will not exceed the recommended limit on the most sensitive receiving water use and in no case exceed 83 degrees F in warm water fisheries, and 68 degrees F in cold water fisheries, or in any case raise the normal temperature of the receiving water more than 4 degrees F.

Item: 8. Chemical constituents.

Criteria: None in concentrations or combinations which would be harmful or offensive to human or harmful to animal or aquatic life or any water use specifically assigned to this class.

Item: 9. Radioactivity.

Criteria: None in concentrations or combinations in excess of the limits specified by the United States Public Health Service Drinking Water Standards.

Class C -- These waters are suitable for recreational boating and secondary water contact recreation, as a suitable habitat for wildlife and fish indigenous to the region, for certain agricultural and industrial uses, have good aesthetic values, and under certain conditions are acceptable for public water supply with treatment and disinfection.

Item: 1. Dissolved oxygen.

Criteria: Not less than 5 mg/l during at least 16 hours of any 24 hour period, nor less than 3 mg/l at any time. For seasonal cold water fisheries at least 6 mg/l must be maintained during the season.

Items: 2. Sludge deposits-solid refuse-floating solids-oil-grease-scum.

Criteria: None other than of natural origin or those amounts which may result from the discharge from waste treatment facilities providing appropriate treatment. For oil and grease of petroleum origin the maximum allowable concentration is 15 mg/l.

Items: 3. Color and turbidity.

Criteria: None allowable in such concentrations that would impair any uses specifically assigned to this class.

Item: 4. Coliform bacteria.

Criteria: None in such concentrations that would impair any usages specifically assigned to this class, see note 1.

Items: 5. Taste and odor.

Criteria: None in such concentrations that would impair any uses specifically assigned to this class, and none that would cause taste and odor to edible fish.

Item: 6. pH.

Criteria: 6.0--8.5

Item: 7. Allowable temperature increase.

Criteria: None except where the increase will not exceed the recommended limits on the most sensitive receiving water use and in no case exceed 83 degrees F in warm water fisheries, and 68 degrees F in cold water fisheries, or in any case raise the normal temperature of the receiving water more than 4 degrees F.

Item: 8. Chemical constituents.

Criteria: None in concentrations or combinations which would be harmful or offensive to human life, or harmful to animal or aquatic life or any other water use specifically assigned to this class.

Item: 9. Radioactivity.

Criteria: None in such concentrations or combinations in excess of the limits specified by the United States Public Health Service Drinking Water Standards.

NOTE 1 -- no bacteria limit has been placed on Class "C" waters because of the urban runoff and combined sewer problems which have not yet been solved. In waters of this class not subject to urban runoff or combined sewer discharges the bacterial quality of the water should be less than an average of 5,000 coliform bacteria/100 ml during any monthly sampling period. It is the objective of the Division to eliminate all point and non-point sources of pollution and to impose bacterial limits on all waters.

[1]MASSACHUSETTS WATER QUALITY STANDARDS

(Water Resources Commission Rules and Regulations for the Establishment of Minimum Water Quality Standards and for the Protection of the Quality and Value of Water Resources; Adopted April 11, 1974; Effective May 2, 1974)

The sanitary wastewater generated at the existing site flows to the Deer Island Treatment Plant by means of the Ward Street Headworks. The Deer Island Treatment Plant has been in operation since June 1968, and serves an area of approximately 170 square miles with a total population of approximately 1,500,000. The plant was designed for an average flow of 343 million gallons per day and a maximum flow of 925 million gallons per day. The treatment process includes the following provisions:

1) coarse and fine screening and grit removal at all headworks;

2) prechlorination;

3) pre-aeration of the influent for a ten-minute period;

4) primary sedimentation; and

5) post-chlorination.

The liquid plant effluent is discharged through two submerged outfalls. Raw sludge is treated by separate sludge thickening prior to high rate digestion. The digested sludge is chlorinated before discharge to the sea on outgoing tides. The average flow for the fiscal year 1973 was 343 million gallons per day, with a maximum flow of 574 million gallons per day. The day-to-day, dry-weather flow fluctuation for the plant is over one million gallons per day.

The outer harbor (where the two discharge outfalls are located) is classified SB. The water quality criteria for Class SB are given in Table 4.3-6. The outer harbor does not meet the criteria in Items 2 and 8 (determined by ERT through review of applicable literature plus field observations). The dissolved oxygen standard is currently being met.[4] The 1971 sampling program of the Massachusetts Department of Public Health found that the median coliform levels detected at the treatment plant outfalls were below 1000/100 ml.[4] The outer harbor water is of low productivity, with the concentration of phytoplankton less than that normally associated with the currently measured levels of phosphate and nitrate.

The Federal Water Pollution Control Amendments of 1972 have set a goal of 1977 for installation of secondary treatment at all public works treatment facilities. The timetable for achieving this goal was greatly

TABLE 4.3-6

CLASS SB WATER QUALITY CRITERIA

Class SB -- These waters are suitable for bathing and recreational purposes including water contact sports and industrial cooling, have good aesthetic value, are an excellent fish habitat and are suitable for certain shell fisheries with depuration (Restricted Shellfish Areas).

WATER QUALITY CRITERIA

Item: 1. Dissolved oxygen.
Criteria: Not less than 5.0 mg/l at any time.
Items: 2. Sludge deposits - solid refuse - floating solids - oils - grease - scum.
Criteria: None other than of natural origin or those amounts which may result from the discharge from waste treatment facilities providing adequate treatment. For oil and grease of petroleum origin the maximum allowable concentration is 15 mg/l.
Items: 3. Color and turbidity.
Criteria: None in such concentrations that would impair any uses specifically assigned to this class.
Item: 4. Total Coliform bacteria per 100 ml.
Criteria: Not to exceed an average value of 700 and not more than 1000 in more than 20 percent of the samples.
Items: 5. Taste and odor.
Criteria: None in such concentrations that would impair any uses specifically assigned to this class and none that would cause taste and odor in edible fish or shellfish.
Item: 6. pH.
Criteria: 6.8--8.5.
Item: 7. Allowable temperature increase.
Criteria: None except where the increase will not exceed the recommended limits on the most sensitive water use.
Item: 8. Chemical constituents.
Criteria: None in concentrations or combinations which would be harmful to human, animal or aquatic life or which would make the waters unsafe or unsuitable for fish or shellfish or their propagation, impair the palatability of same, or impair the water for any other use.
Item: 9. Radioactivity.
Criteria: None in such concentrations or combinations in excess of the limits specified by the United States Public Health Service Drinking Water Standards.

hindered by a former president's impoundment of a large percentage of the necessary funding. Construction and planning delays have also hindered achievement of this goal. The MDC, Army Corps of Engineers, EPA, and the Massachusetts Division of Water Pollution Control (among other state agencies) are currently assessing plans to upgrade the MDC treatment plants. Two alternative proposals for the upgrading of the Deer Island Treatment Plant are:

1) installation of secondary treatment, and

2) extention of the outfalls well into Massachusetts Bay.

The next round of public hearing concerning these plans will be held approximately around April, 1975.

Since the sewage loads from the existing site are well below the dry-weather, day-to-day flow variation of the Deer Island Treatment Plant, they would have an insignificant impact upon the treatment plant. The effects of this incremental sewage load on the outer harbor would probably be undetectable by conventional methods due to both the actual accuracy of the standard water quality tests and the background "averaging" generated by the diurnal tidal motion.

Water Supply

The water demand for the site is furnished by City of Boston supply lines. Boston is a member of the Metropolitan Water District, which supplies water to approximately 35 regional communities. The main source of water for the site originates from Quabbin Reservoir, which is located in the central part of Massachusetts east of the Connecticut River. The Quabbin Reservoir supply is considered to be of excellent quality. The safe yield (maximum dependable draft which can be made on a source of water supply during an extreme drought period) for the MDC supply system has been estimated by the MDC to be from 251 to 290 million gallons per day. These are revised figures which reflect hydrological analysis of the drought experienced during 1961-1967. The projected 1975 average daily consumption for both fully and partially supplied MDC member communities is 292 million gallons per day.

The MDC is currently actively pursuing contract negotiations for the Northfield Mountain Project. The Northfield Mountain Project involves partial diversion of flow from the Connecticut River to Quabbin Reservoir approximately 70 days per year. This will increase the safe yield by an estimated 72 million gallons per day. The MDC is also examining possible treatment of Sudbury Reservoir such that it can be used on a more permanent basis. Other potential sources of additional supply include diversions of the Millers, Tully, and Deerfield Rivers.

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4.4 Geology and Geohydrology

Site and Project Area Physiography

The total energy plant site on the west side of Boston is gently sloping to the south-west and west with elevations ranging from approximately 35 to 45 feet (mean sea level). One block to the west is the Muddy River with an average surface elevation of 2.9 feet (msl). Approximately two-thirds of a mile to the south is Parker Hill, a drumlin rising to over 200 feet (msl). This hill and the Muddy River are the primary influences on the drainage of the project area.

Area Geology

The site lies in the Boston Basin, a structurally controlled depression bounded by faults to the north and west and intrusives (the Quincy Granite, forming the Blue Hills) to the south. Bedrock within the basin generally consists of the Cambridge Argillite in northern sectors and the Roxbury Conglomerate to the south. Both are much younger than the enclosing crystalline rocks outside the basin. The Roxbury Conglomerate can be seen cropping out approximately one mile to the south along the Jamaicaway.

Pleistocene glaciation did much to sculpture the basin. Numerous drumlins appear; most of the basin is covered with poorly sorted outwash sands and gravels. Occasional morrainal material can also be found. Marine invasion during the Pleistocene resulted in deposition of the Boston Blue Clay, a very low strength sediment well known for the resulting foundation problems. This unit is particularly common in Back Bay and other areas which were filled. Most of this filling, which is to the north and east of the project site, was done during the 1800's.

Structurally, there are a number of faults within the Boston Basin, including the Stoney Brook Fault. This is a right lateral tear fault striking approximately north-south and lying, at its closest approach, about one-third mile to the west of the proposed project site. There is no known recent movement along either this or any of the several associated faults.

There is, however, considerable seismic activity in and off-shore of this region. Most of this is of low magnitude, but it should be noted that the U. S. Geological Survey places Boston and much of southern New England in a zone of high seismic risk. The basis for this lies, however, in the historical recording of several (presumed) severe earthquakes in colonial times. Because of the lack of seismic instruments, the data are necessarily subjective and possibly overrated. In contrast to California and other commonly recognized seismic areas, the majority of New England seismic events have a fairly random spatial distribution, often off-shore, and most generally not correlated with older fault zones.

Mineral resources in the Boston Basin consist of sands and gravel. Locally, sands have been quarried from the Parker Hill drumlin.

Site Geology and Geohydrology

The site is presently occupied by a number of homes and apartment buildings. No outcrop exists and the exposed soils, generally backfill, are a mixture of poor loam and construction debris.

Significant subsurface study of this site has not been made; however, two boreholes within the site and more extensive data from areas immediately adjacent allow a reasonable estimate of the prevailing subsurface

conditions. In the study of a site to the southwest, Geotechnical Engineers Inc. (GEI) dug nineteen boreholes, seven of which were established as observation wells. Premeability tests were conducted in six of the latter as well as in two additional boreholes. The borehole plan is shown in Figure 4.4-1, and logs of the holes are given in Appendix A.

Judging from the GEI data, the site is covered with from one to twelve feet of fill, generally a black sandy to silty mixture of poor loam and construction debris, underlain by twenty-five to thirty-five feet of silty glacial clays, yellow to gray in color. Below this are eighteen to thirty feet of dense, poorly sorted, medium to fine, brown to yellow outwash sand, which overlay an additional twenty-five to thirty-five feet of till. The till is a very dense, very poorly sorted fine gray silty sand with some gravel and occasional cobbles. It rests on a deeply weathered, gray-green conglomerate, probably the Roxbury Formation. The boreholes did not all extend to bedrock, but it appears that the old Roxbury surface lies at a depth of from 58 to 78 feet below mean sea level (msl) and slopes generally to the west and an approximate gradient of 8% and as much as 16% locally.

As for the earlier mentioned clays, they are gray to yellow in color, have moderate to low plasticity, respectively, and are generally quite stiff. They have a moderate silt content and fine sand pockets are common. There is a slight trend toward thinning of the clays and replacement by an increased thickness of the fine to medium sands just southwestward of the project site. Typically, all of these glacial and glacio-fluvial deposits are very poorly sorted, contain numerous lenses, stringers and channel fill material of considerably coarser grade. Gravels, cobbles, and occasional boulders are found throughout; lateral continuity of any particular sedimentary horizon is generally slight. No peat or other organic matter was noted in any of the boreholes.

Water Table

The water table in the vicinity of the site is about 11 feet (msl). Because of the large percentage of paved or developed land there is little infiltration from precipitation and negligible evapotranspiration. Since the water table is maintained by the Muddy-Charles River basin system it is most doubtful that seasonal fluctuations in the

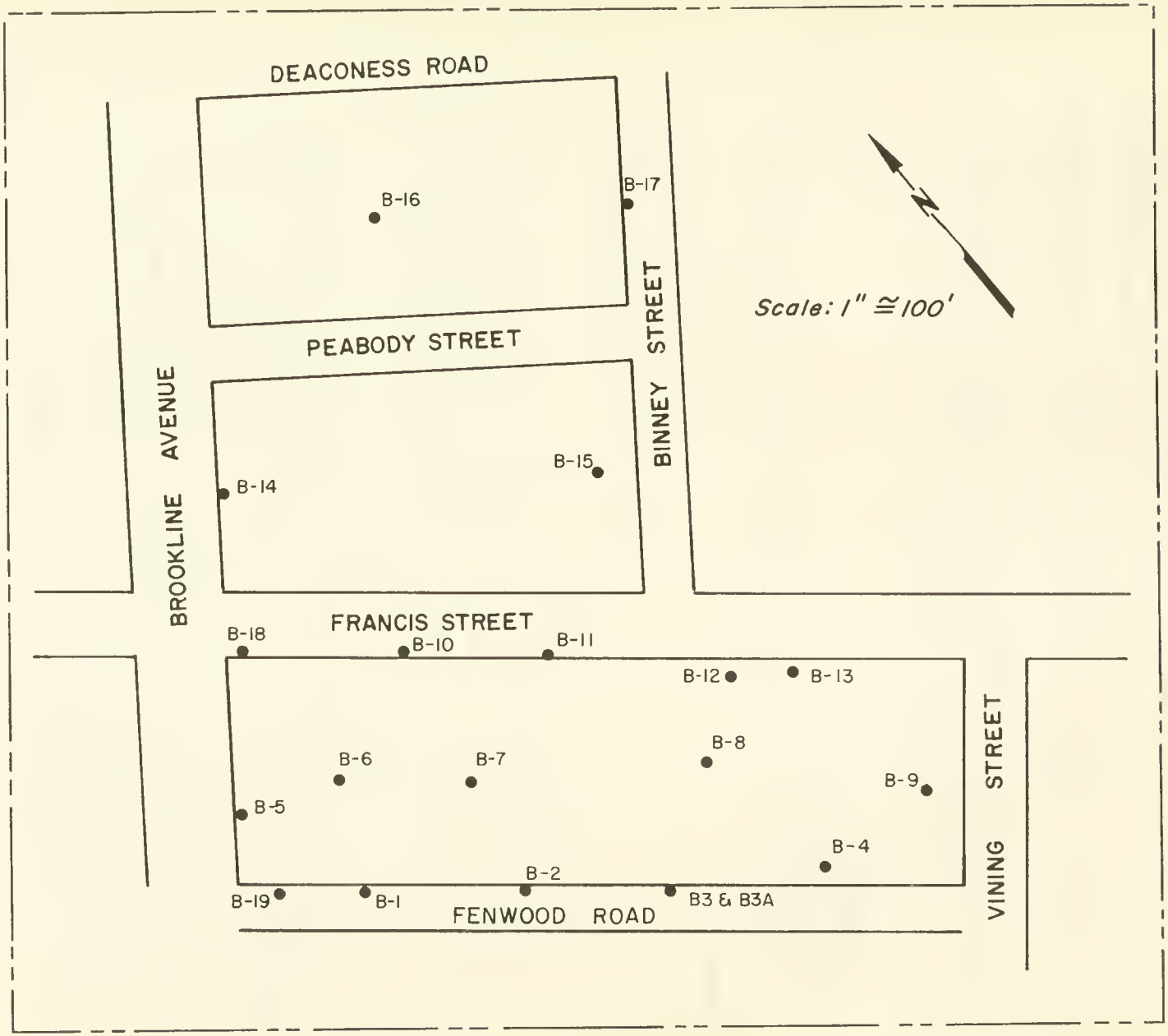

Figure 4.4-1 Location of Boreholes

phreatic surface would amount to more than a foot or two. Groundwater flow under the site is believed to be generally to the west and northwest with a gradient of less than 0.5%. Though there is no evidence for any perched water tables, some suspicious losses of drilling fluid indicate the possible existence of isolated, locally porous, unsaturated sediments within generally impervious lenses. Such losses occurred in boreholes B-11 and B-12 at a depth of approximately -25 feet (msl) and in hole B-14 at an elevation of approximately -45 feet (msl).

Permeability

Permeability tests were also conducted by GEI on both the till and the overlying sands. Data from these tests, Appendix A, confirm expectations from sample study. Specifically, permeability ranges from 3 x 10^{-6} to 3 x 10^{-4} cm/sec as one goes from the lower to upper layers of the till. In the sands moderate to low permeabilities were found (10^{2} to 10^{-3} cm/sec, with one exception) with the lower values at those holes most closely correlated with the proposed site.

Though no permeability tests were performed in the clay horizons, it is obvious from their composition that values must be lower than in the till (more impermeable), except for those limited cases where a sufficient number of sand-filled stringers and channels interconnect creating a narrow channel through the clays.

Ground water flow under the site is then primarily dependent upon the sand horizons which begin 35 to 40 feet below the ground surface at a depth of 0 to 5 feet (msl); the sands rise about 10 feet just to the southwest. Flow and percolation rates in the clays above are expected to be very low. The base of the sands ranges from a minimum depth of -11 feet (msl) under the Binney Street end of the site to a depth of -32 feet (msl) toward the Brookline Avenue side.

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4.5 Noise Levels

General Characteristics of Community Noise

The noise environment of an urban community has a base of steady "background" noise, which is the result of innumerable noise sources spread throughout the city. Superimposed on the background noise is the noise of the individual local sources which can vary from an occasional aircraft flying over, occasional sirens and horns, to the virtually continuous noise from the traffic on a nearby major highway.

To describe noise environments and to assess impact on noise sensitive areas, a frequency weighting measure which simulates the human perceptions is customarily selected. A-weighted ratings of noise sources, which reflect the human ear's reduced sensitivity to low frequencies, have been found to correlate well with human perceptions of the annoying aspects of noise, particularly for traffic noise sources. A-weighted noise levels will be designated dBA in this report. Table 4.5-1 identifies noise levels associated with some common activites and sources of noise.

Both the fluctuation of the noise level and the maximum noise levels are important in assessing potential noise impact. Noise fluctuation may be described by determining those levels exceeded a certain percentage of the time. For a specified time period, the 90th percentile noise level, L_{90} (the noise level exceeded 90% of the time), is

TABLE 4.5-1

COMMON NOISE LEVELS[1]

Sound Level (dBA)	Associated Activity
130	Threshold of Pain
120	Chipping on Metal
110	Rock Band
100	Jack Hammer
	Jet Take-off (1/2 mile)
90	Threshold of Hearing Damage
80	Shop in Shipyards
	Busy Freeway
70	Downtown Traffic
	Electric Typewriter
60	Normal Conversation
	Urban Residential Area (Nearby Traffic)
50	Drafting Office
40	Suburban Neighborhood (Distant Traffic)
	Private Office
30	
20	Quiet Rural Area (No Traffic)
10	
0	Threshold of Audibility

generally considered as background. The L_{50} level represents the median noise levels. The 10th percentile level, L_{10}, is generally indicative of the higher noise levels occuring over the given time period. In the case of urban communities, the L_{10} level indicates the character of localized traffic noise sources.

The Boston Air Pollution Control Commission has set maximum allowable noise level standards for zoning districts established by the zoning code of the City of Boston. These levels are shown in Table 4.5-2. Criteria are also recognized by noise analysts that a new project should not dissrupt the serenity and quiet that is essential for the area to continue to serve its intended purpose. Therefore, background noise measurements have been taken in the project area to determine if noise standards are being exceeded and to establish maximum design levels for the proposed project.

Based on the measurement program it was found that community noise levels in the project area are in compliance with the standards of the City of Boston Air Pollution Control Commission, except for locations immediately adjacent to the existing power plant, and locations along Brookline Avenue.

Existing Sources of Noise

Sources of noise in the community around the proposed site of the energy plant can be divided into two categories· those related to transportation, and stationary sources related to industrial, commercial, and institutional uses.

Transportation Noise Sources

The area is exposed to noise from three major arterial routes. Huntington Avenue serves trucks and commercial vehicles as well as street cars and is characterized by stop-and-go traffic. Brookline Avenue, which has a somewhat higher traffic volume but no trolley service, runs adjacent to the Energy Plant site. The Riverway close to the site excludes trucks but is characterized by high, peak-hour traffic volume and average speeds of 35 to 45 mph.

TABLE 4.5-2

TABLE OF ZONING DISTRICT NOISE STANDARDS ADOPTED BY THE CITY OF BOSTON AIR POLLUTION CONTROL COMMISSION, 1970

Octave Band Center Frequency of Measurement (Hz)	Maximum Allowable Octave Band Sound Pressure Levels (dB)					
	Residential		Business		Industry	
	Daytime[1]	All Other Times	Daytime	All Other Times	Daytime	All Other Times
31.5	76	68	79	72	83	79
63	75	67	78	71	82	78
125	69	61	73	65	77	73
250	62	52	68	57	73	68
500	56	46	62	51	67	62
1000	50	40	56	45	61	56
2000	45	33	51	39	57	51
4000	40	28	47	34	53	47
8000	38	26	44	32	50	44
Approximate Single-Number-System (dB(A))[2]	60	50	65	55	70	65

[1]Monday through Saturday, 7 AM through 10 PM

[2]For preliminary survey and monitoring purposes only.

Since Brookline Avenue is the major arterial roadway closest to the site, it has the largest impact on the character of noise in the community (i.e., on the L_{10} levels) around the site. The higher speeds and larger volume of automobile traffic along the Riverway and the truck and trolley traffic on Huntington Avenue, in addition to Brookline Avenue, control the overall background levels and set the noise "floor" in the community from traffic sources.

Other transportation noise sources such as aircraft or elevated rapid transit do not pose a serious noise problem in this community. Sirens from police cars, ambulances and fire trucks result in short-term, high levels. These levels or their frequency were not included in the measurement program.

Stationary Noise Sources

The only major stationary noise source within the community is the existing power plant located on Blackfan Street. The noise created by the cooling towers on this facility determines the baseline noise levels in the surrounding area. However, the noise is strongly attenuated within three blocks of the plant due to the presence of taller buildings on all sides of the cooling towers.

There is, in addition, considerable construction activity near the area which contributes intermittently to daytime noise levels.

Ten sites were used to characterize the sound levels in the project area. The locations shown in Figure 4.5-1 were selected based on their orientation to the proposed project and sensitive receptors. The sound levels measured at each location is listed in Table 4.5-3, and show that the existing power plant is the most prominent source of noise in the adjacent areas and that traffic dominates in areas further removed from the existing power plant. A brief description of each location and the type of measurement taken is listed below.

Figure 4.5-1 Sites Used to Characterize Sound Levels in the Project Area

TABLE 4.5-3

MEASURED BACKGROUND NOISE LEVELS

Measurement Location No.	Sound Level (dBA) Weekday Sound Level (dBA)	Dominant Source	Sunday Sound Level (dBA)	Dominant Source
1	60	GBT*	52	Existing Power Plant and GBT. (Measured at Midnight on a Weekday)
2	54	GBT*	44	GBT*
3	55	GBT*	49	Children Playing and GBT*
4	58	Francis Avenue Traffic and Existing Power Plant	--	Not Measured
5	58	GBT* and Existing Power Plant	50	GBT* and Existing Power Plant
6	69	Existing Power Plant	66	Existing Power Plant
7	--	Not measured due to construction activity	57	Existing Power Plant and Brookline Ave. Traffic
8	68	Brooklin Ave. Traffic	62	Brookline Ave. Traffic
9	77	Existing Power Plant	74	Existing Power Plant
10	64	Huntington Ave.	--	Not measured
Allowable Single number Sound Pressure Level for residential areas (dBA)	60		50	

*GBT = general background traffic.

Description of Noise Sampling Sites

Site No. 1 - 83 Francis Street

24-hour measurements were taken at this site. The microphone was located approximately 5 feet outside a 2nd story window in this building, 20 feet above street level. The window was on the Binney Street side, near the corner of Binney and Francis Streets. Octave band noise level measurements were made at street level on Binney Street. Some measurements were also made from a 2nd story window on the Francis Street side of the building.

Site No. 2

This measurement site is located at street level in the front of the west wing of the Massachusetts Mental Health Center (MMHC) on Fenwood Road. The site is well-shielded from the proposed plant site as well as from the present power plant by the multifamily houses between Francis Street and Fenwood Road. The MMHC building provides shielding from the traffic noise from Huntington Avenue and the Riverway. MMHC is obviously a sensitive receptor of noise and any impact on this receptor should be carefully evaluated.

Site No. 3

This site is located on Vining Street, in a vacant lot adjoining Fenwood Road. It is representative of the residential district to the south of Francis Street that will be impacted by the proposed Energy Plant. Although the buildings on Blackfan Street, Children's Road, and Francis Street provide some shielding to the noise from the existing plant, nighttime noise levels at this site may be influenced by the existing power plant when background traffic noise is at a minimum level.

Site No. 4

This location is in the parking lot on Francis Street, between Peter Bent Brigham Hospital and the proposed Energy Plant site. A new hospital building (the Affiliated Hospital's Center) has been proposed at this site, which will be an important receptor of the noise from the proposed Energy Plant because of the direct line of site across Binney Street.

Site No. 5

Located on Binney Street in front of the House of Good Samaritan building, this site is shielded from most of the traffic noise from Brookline Avenue and Francis Street, but is affected by the existing power plant. Consequently, noise levels would be fairly steady at this location except for occasional passenger cars on Binney Street. This site is also representative of the existing conditions at the property line of the Frederika Home, which is a residence for elderly people.

Site No. 6

This location is at the side entrance to the Children's Hospital on Blackfan Street, directly opposite the secondary cooling tower at the northeast corner of the existing power plant. Noise from the primary cooling towers was predominant here, even though the cooling tower bays do not have any louvers opening on the Blackfan Street side.

Site No. 7

This site on Deaconess Road, opposite the new Sidney Farber Cancer Center, is affected by traffic noise from Brookline Avenue as well as cooling tower noise from the existing power plant. The Cancer Center and the Frederika Home will be sensitive receptors to the noise generated by the Energy Plant.

Site No. 8

This site is located on the corner of Francis Street and Brookline Avenue. Because the site receives traffic noise from a large segment of Brookline Avenue, noticeably higher noise levels would be expected at this measurement location than at the sites along the less traveled side streets. The site is also likely to be impacted by the energy plant noise due to its nearness to the proposed site.

Site No. 9

This site was chosen to illustrate the effect of urban structures on street noise levels near a prominent noise source. The site was about 75 feet from the open louvers of the existing power plant cooling towers and about 12 feet from the face of the Sidney Farber Cancer Center on Children's Road. Extremely high continuous noise levels were recorded at this location.

Site No. 10

This site is located on Huntington Avenue near Kempton Street. The microphone was located approximately 5 feet from a second floor apartment window. Data from measurements at this site, made earlier to determine existing noise levels at the Mission Park project site, was useful for comparison with the levels in the present project area.

Weather Conditions During Measurements

The measurements were performed in the absence of high wind conditions. Maximum wind gust levels, measured by a handheld anenometer, were 10 mph. A wind screen over the microphone was always employed while making the noise measurements.

There was no appreciable precipitation during the period of measurements. Temperatures ranged from 25°F at night to 50°F during the daytime.

Measurement Results

Noise measurements can be broadly classified into three types:

1) Diurnal variation of noise

2) Single number background sound level measurements at a given time of day

3) Octave band measurements at a given time of day

Since it is not practical to monitor noise levels continuously at all important locations in a project area continuous measurement or sampling to given the diurnal variation is usually confined to one or two representative sites in a project area, while background levels including

A-weighted and octave band levels are measured only once at several other selected sites. The two types of data can later be combined to make reasonable estimates of the character and variation of noise within the entire project area.

The instrumentation used for these measurements is explained in Appendix B.

Diurnal Variation of Noise

Measured percentile noise levels for the 24-hour period from 11 PM, December 3 to 11 PM, December 4, 1974, at Site No. 1, Corner of Francis and Binney Streets, are shown in Figure 4.5-2. The percentile levels shown are based on the accumulated A-weighted levels during the one-hour periods preceding the times shown on the horizontal scale. The peak L_{10} level during this period is relevant to sensitive receptors of roadway noise in the project area, while the L_{90} level is a good measure of background noise. Small differences (less than 10 dB) between L_{10} and L_{90} during the nighttime period are indicative of the predominance of steady stationary noise sources during the given period, while larger differences during daytime indicate traffic noise predominance. The minimum L_{90} level of 51 dBA can, therefore, be considered to be associated with the existing power plant noise.

Traffic volume data indicates morning peak vehicle volume on Francis and Binney Streets to be almost twice that of the afternoon peak levels on these streets. This is reflected in Figure 4.5-2 which indicates that the morning peak L_{10} level is 3 dB higher than the afternoon peak L_{10} level.

Figure 4.5-3 shows the diurnal variation of noise levels at site No. 10 overlooking Huntington Avenue. The noise is almost completely due to traffic since the existing power plant is approximately 1400 feet from the site with numerous buildings in between. Also plotted in the figure are the traffic volumes on Huntington Avenue on a typical weekday which demonstrates the noise dependency on traffic.

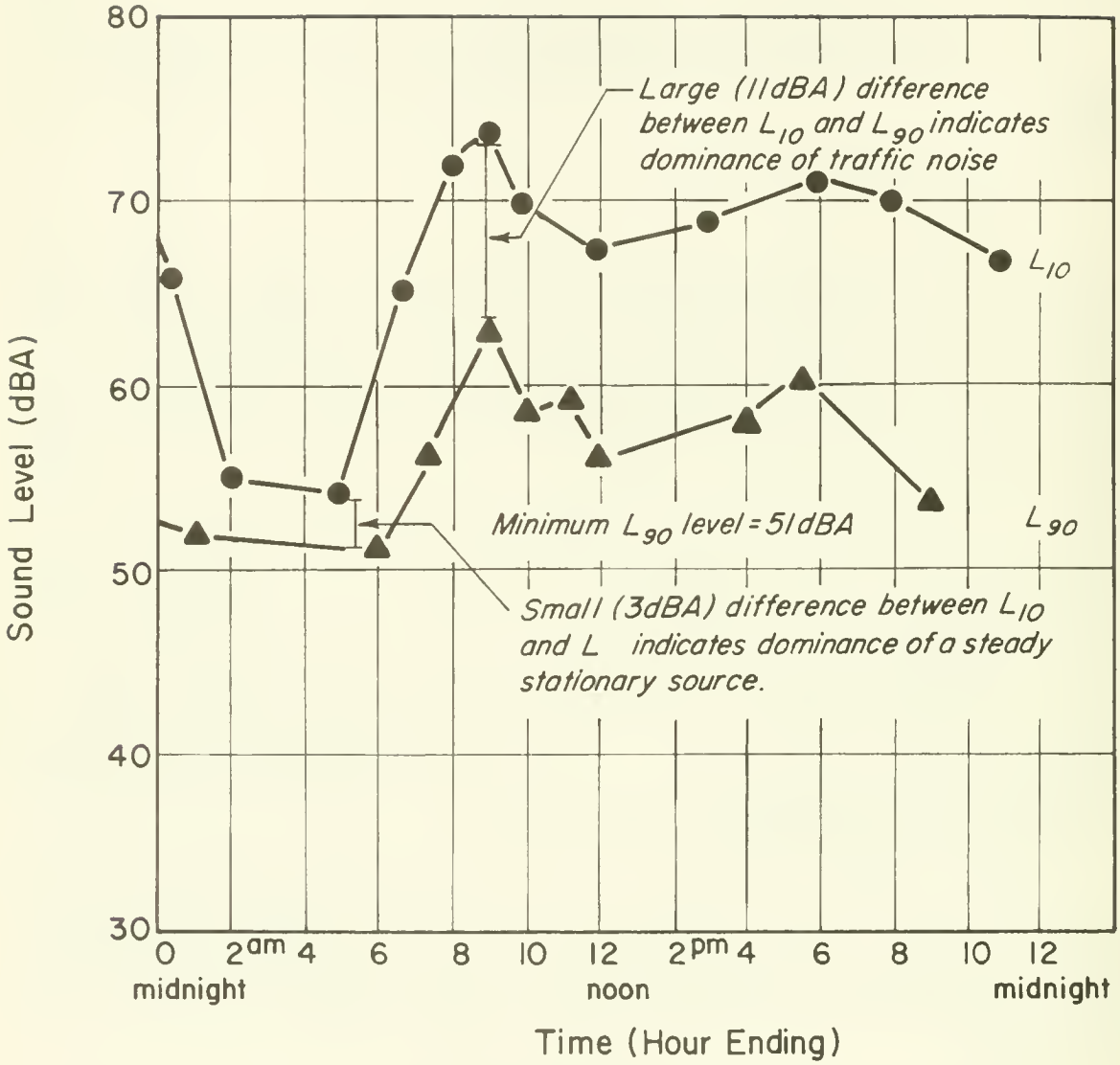

Figure 4.5-2 Measured Percentile Noise Levels Measured at Site 1

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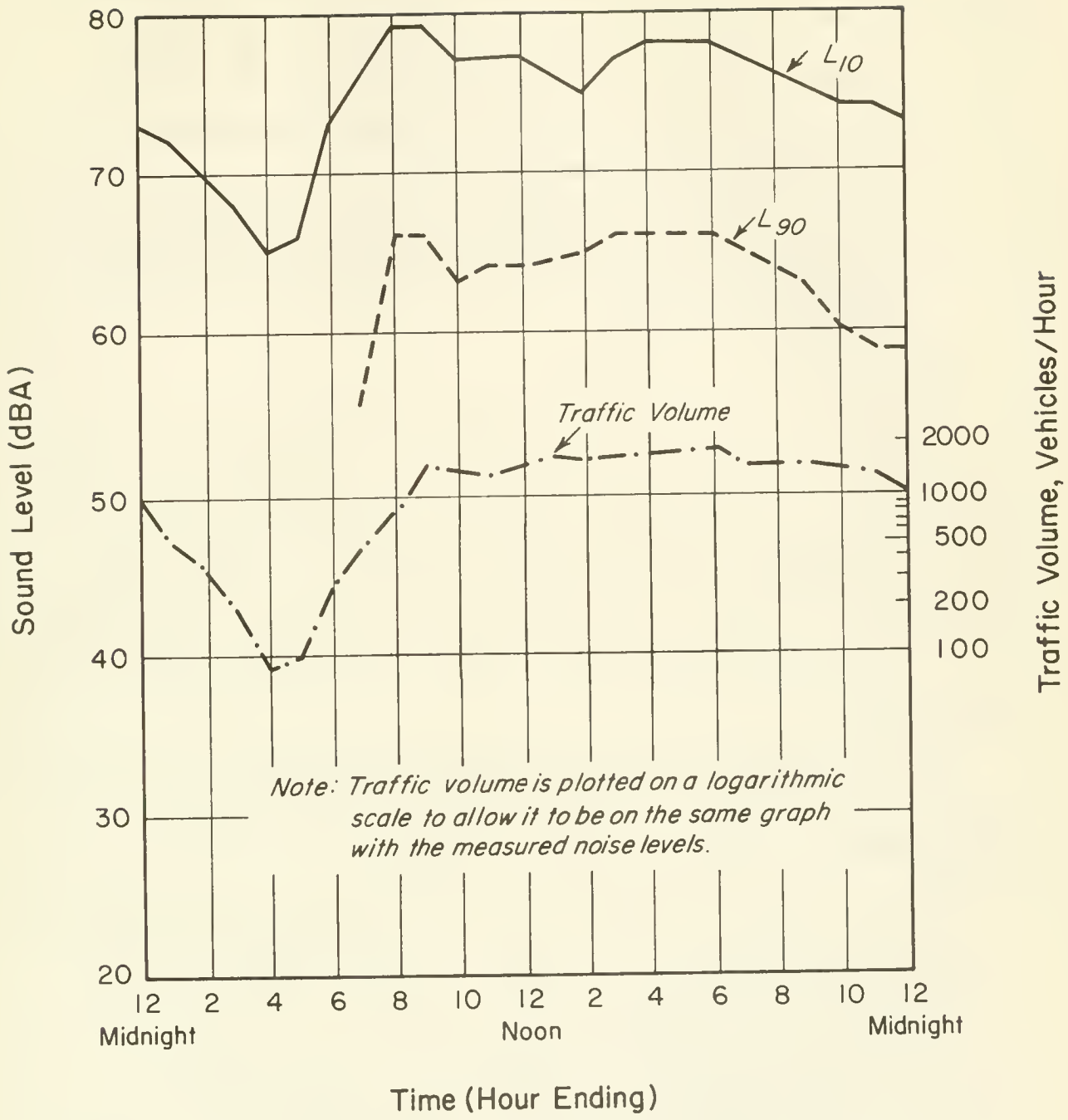

Figure 4.5-3 Comparison of Measured Noise Levels at a Site on Huntington Avenue

A comparison of percentile noise levels at sites 1 and 10 (near and further from the project) during similar time periods shows that:

1) Noise levels are lower at all times at site 1, which is the site of the proposed energy plant, than those at site 10, which is located on Huntington Avenue.

2) Noise at both sites is dominated by traffic sources except during 2 to 5 AM at site 1 when the noise from the existing power plant dominates.

Background Levels, A-Weighted

Background noise levels were obtained by averaging by eye the sound level reading over time periods of approximately 5 seconds duration when no single vehicle was heard above the general traffic in the area. This process was repeated several times until it became clear that further measurement samples would not give a lower average reading than the one already taken. Hence the background reported is the average minimum over a time period of several seconds. These levels are reliable to within ± 2 dBA.

Table 4.5-3 summarizes the background levels measured at various sites during the morning of a weekday (November 31, 1974) and on a Sunday (December 3, 1974). The dominant noise source contributing to the levels at the site is also noted in the table.

It is not possible to infer noise contours from this data because of the proximity of buildings. Even so, the strong influence of the existing power plant on Blackfan Street is apparent. Due to the shielding effect of the surrounding buildings, however, the noise levels on Fenwood Road and Vining Street (55 dBA) are at a level comparable to those due to traffic noise sources alone. High background levels (68 dBA) were measured on Brookline Avenue near the proposed site. Sites 4 and 5 appear to be influenced by both traffic and power plant noises. Noise levels measured at the same locations on Sunday showed a decrease in background levels of 3 dBA near the existing power plant and from 6 to 11 dBA elsewhere. Nighttime noise levels at these sites could not be measured due to high wind conditions during the scheduled measurement period.

Background levels - Octave Band Analyses

Comparison of the existing noise conditions in regions affected directly by the existing power plant on Blackfan Street and regions where the power plant impact was not observable may be made by examining the octave band spectra of noise at selected sites. Background noise levels on Fenwood Road in front of the MMHC Building (Site 2) are controlled by general traffic on the arterial routes passing through or near the project area, while the location of site 6 on Blackfan Street is directly impacted by cooling tower noise from the existing power plant.

Figure 4.5-4 shows the measured octave band levels at site 6, measured on a weekday and on a Sunday. The 4 dB difference in noise levels between the two days is attributed to one of the two cooling tower fans being shut off during the measurement on Sunday. (Because the decibel (dB) is a logarithmic measure, halving of sound energy results in only a 3 dB decrease in sound level.) Overall noise level on Sunday at site 9 on another side of the cooling towers also measured 3 dB lower than that on Thursday. Also shown in Figure 4.5-4 for comparison are the daytime and nighttime (or Sunday) standards of the City of Boston Air Pollution Control Commission (BAPCC) for Residential Districts. Both daytime and nighttime standards are exceeded. Because of the nearness of the power plant, the levels are not expected to decrease during the nights, except on those occasions when one or both cooling tower fans are not operating.

Background octave band spectra measured on a weekday and a Sunday at site 2 are shown in Figure 4.5-5. This location on Fenwood Road is well shielded from the existing power plant and because of the sparse traffic on Fenwood Road and Vining Street, the background levels measured during short lulls in between individual passings of vehicles would represent a background determined by city-wide transportation sources. During measurements on Sunday, much activity was heard from a children's park across the street from the site. Occasionally measurements had to be interrupted when a minibike was heard or seen near the park. Comparison with the Boston Noise Control standards shows that, with the exception of two or three octave bands, the levels are in

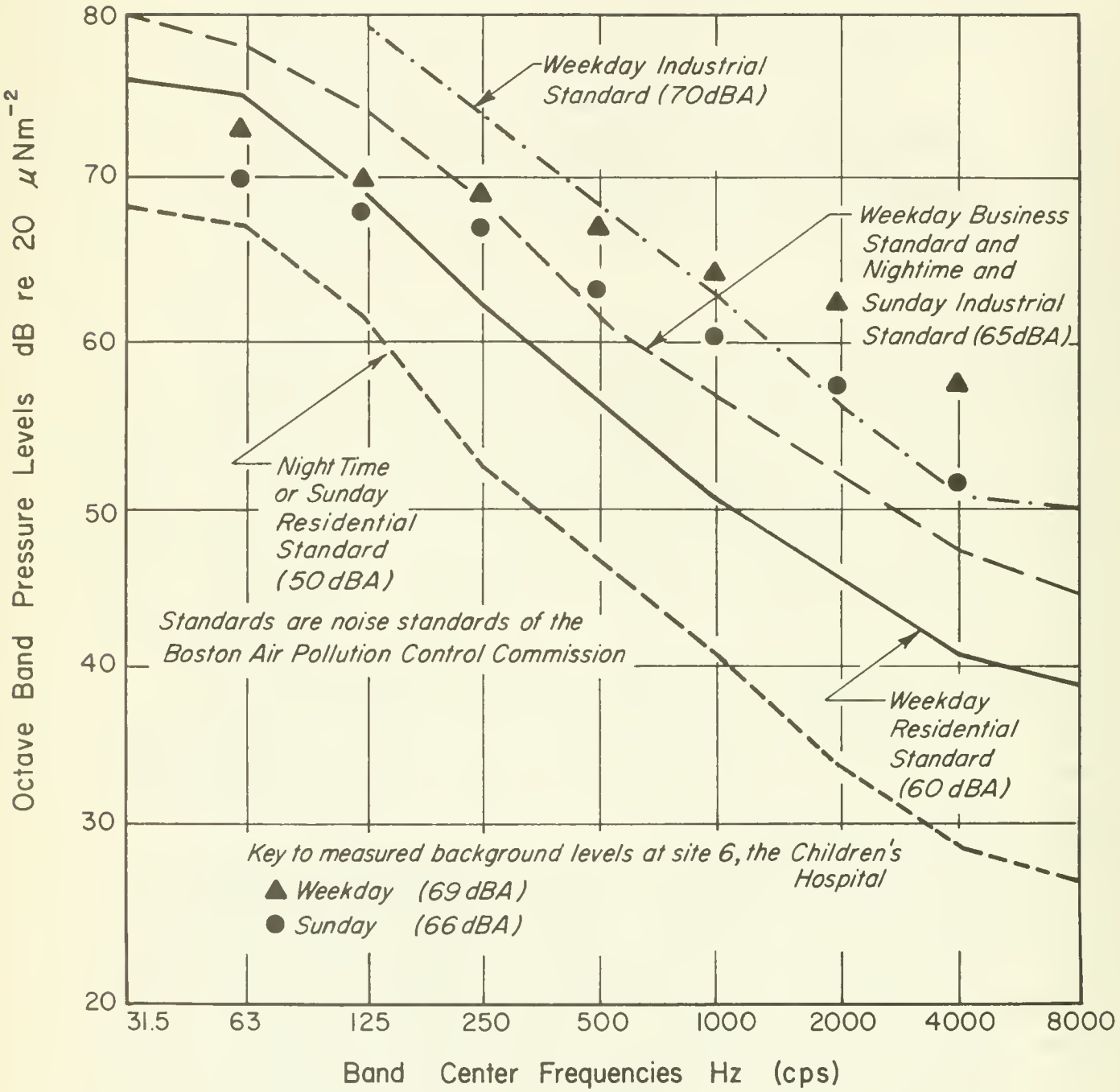

Figure 4.5-4 Octave Band Levels at Site #6

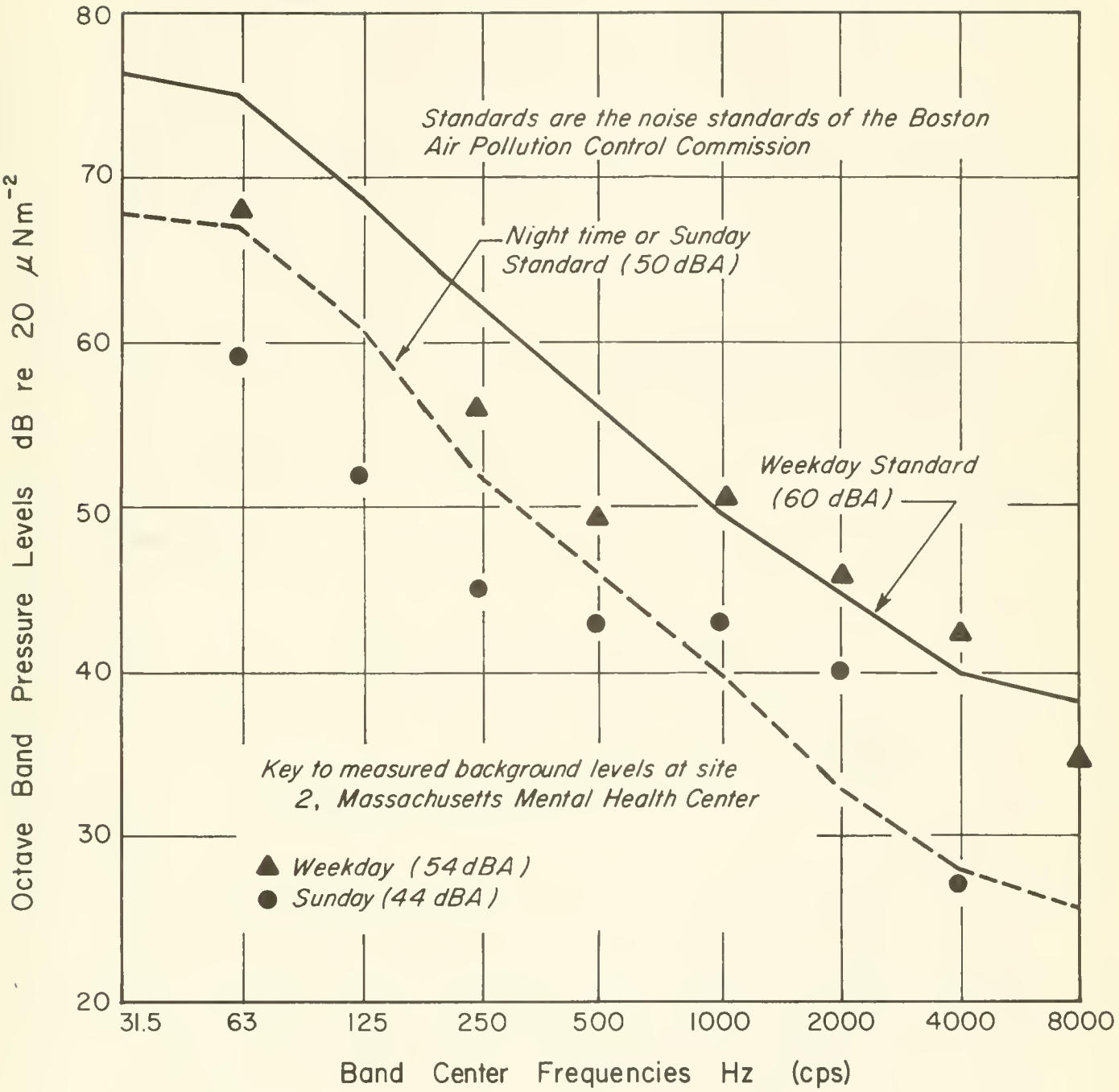

Figure 4.5-5 Octave Band Sound Levels Measured at Site #2

general compliance with the standards. The confidence level of any noise measurement of this type is usually ± 2 dB. Thus exceeding the octave band levels in two or three bands by about 2 dB are not serious. The Sunday measurement (made at 11:55 AM) shows that in the 2000 Hz band, the level exceeds the standard by as much as 7 dB. It is possible that although no minibike could be seen or heard during this measurement, one may have been passing by on an adjacent street, resulting in a temporary increase. Octave band measurement at site 3 on Vining Street, made a few minutes later, indicates a sound level of 35 dB in this octave band, which would put the level within 2 dB of the standard. The overall (dBA) levels are within the recommended limits at this site.

A comparison of the nighttime spectrum levels at the energy plant site (site 1) and the BAPCC nighttime standard is made in Figure 4.5-6. The overall and octave band levels are somewhat higher than the Sunday levels in front of the Massachusetts Mental Health Center (except at 2000 Hz).

No puretone conditions were observed during any of the measurements within the project area.

References for 4.5 Noise Levels

1) Adopted from Acoustical Seminar, Robin M. Towne and Associates, 1971.

4.6 Ecology

The distribution of vegetation on the proposed energy plant site is limited to small lawn areas, alleyways and property behind the existing buildings. With the exception of the Muddy River, an Olmsted System Park within a block of the site, the vegetation in the adjacent areas is also limited to small areas surrounding buildings and parking areas. Along Muddy River, especially the Boston side, there is poor grounds maintenance with excessive undergrowth. Despite the neglect, the undergrowth provides wildlife cover in the midst of the city which is not normally provided by ornamental plantings around buildings.

The existing condition of the vegetation and wildlife habitat on the project site reflects past use and disturbance of the site. The

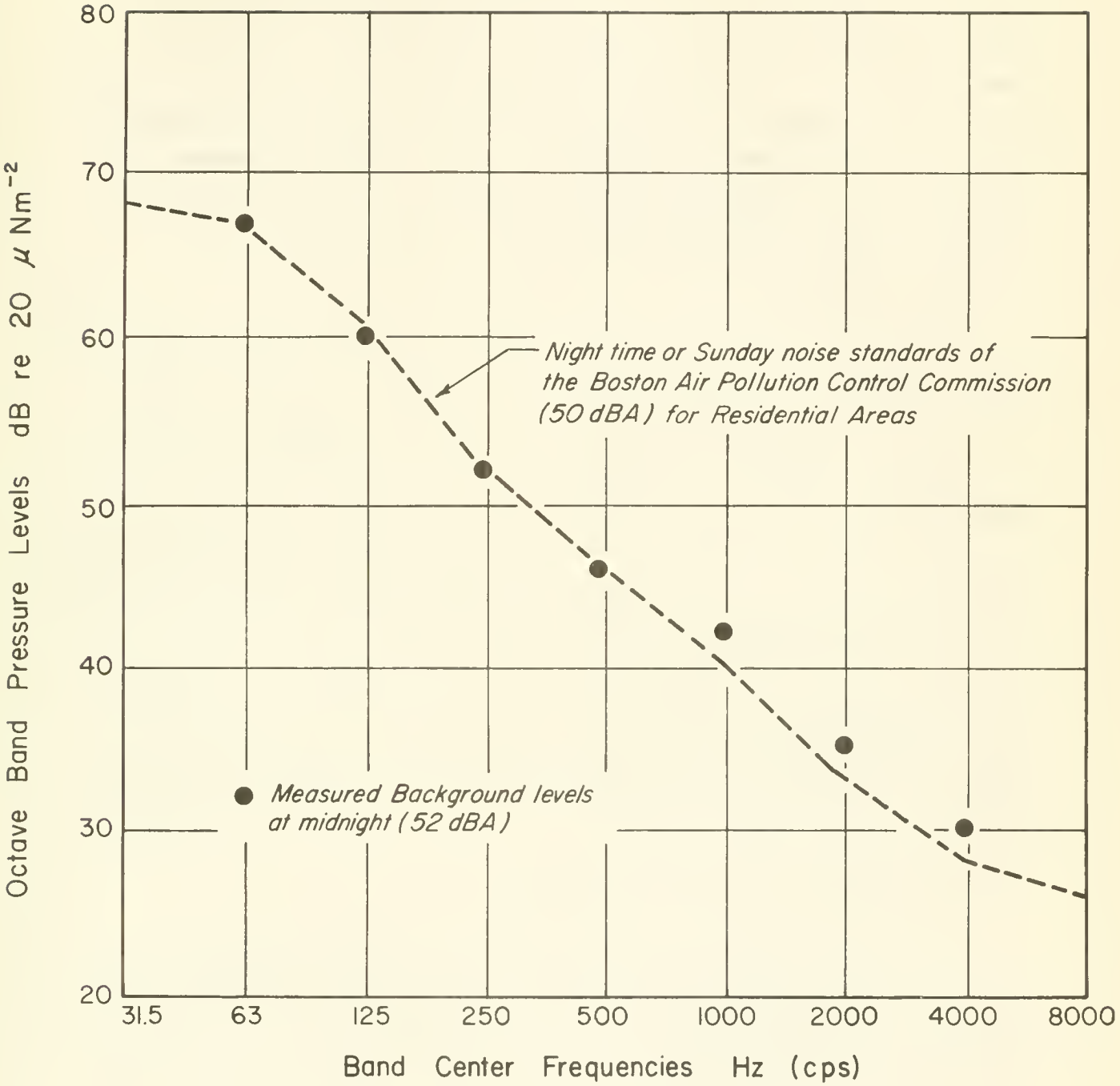

Figure 4.5-6 Octave Band Sound Levels Measured at Site #1 Compared to BAPCC Standards

lawn areas in front of the row houses along Brookline Avenue are neglected and lack vigorous ground cover, shrubs, and trees. The ground cover plants on the site are dominated by wasteland weeds and invasion species commonly found on disturbed land. Ornamental and introduced shade trees, shrubs, and undesirable herbaceous plants are located behind the residential buildings. Tree of Heaven (Ailanthus altissima) thrives particularly well in this urban location. The sites do not provide suitable or significant habitat for rare or endangered plant species as listed by Massachusetts Audubon Society (October, 1973). Vegetation observed on the site is listed in Table 4.6-1.

Despite the existing conditions the area behind the buildings does provide resting, nesting and feeding habitats for common urban, introduced birds (house sparrow, starling and rock dove). The eaves of the row houses are also occupied by these urban dwellers. Hardy gray squirrels presently inhabit the site and make extensive use of the urban surroundings. Most of the wildlife observed on the site would be expected to occupy home ranges which would at least in part, extend outside the site area. It is probable that murid rodents (rats and house mice) occupy the buildings and environs immediately adjacent. The occurrence of rare and endangered wildlife would be highly unlikely due to the small amount of appropriate vegetation in urban Boston. Some small shrubs and herbaceous plants on the site do have forage value for wildlife, but because of the urban setting, few wild animals are present to utilize this potential resource.

4.7 Social and Economic Characteristics

An overview of the neighborhood depicts an area characterized by a declining total population; predominantly white with an increasing black population. The male to female ratio has been about .7 to 1. There is an increasing student population. The average household has 2.36 persons and the average family has 1.19 children. This is an overall low income area with the median family income of $7,500 in 1970. The majority of the work force is composed of white collar workers, many of whom are employed by the health and educational institutions. Housing is generally in a deteriorating condition and is rented.

TABLE 4.6-1

VEGETATION OBSERVED ON THE SITE

Common Name	Botanical Name
Tree Species:	
*Tree of Heaven	Ailanthus altissima
Norway Maple	Acer plantanoides
Black Cherry	Prunus serotina
Colorado Blue Spruce	Picea pungens
Common Shrubs:	
Cedar	Arbor vitae
Hawthorn	Cratregus spp.
Asiatic Bittersweet	Celastrus orbiculatus
Rose	Rosa spp.
Herbaceous (evident in fall site visit)	
Aster	Aster spp.
Ragweed	Ambrosia artemisiifolia
Goldenrod	Solidago spp.
Boston Ivy	Parthenocissus tricuspidata
Japanese Knotweed	Polygonum cuspidatum
Buttercups	Ranunculus spp.
Grasses	

*Dominant tree species on site

General Population Characteristics

For demographic purposes, the population has been analyzed in terms of:

1) the "neighborhood" defined as five census tracts, specifically 0808, 0809, 0810, 0811 and 0103, according to the 1970 definitions (formerly S2, S6, S5, S4 and S1, respectively, in the 1950 and 1960 census). This area is shown on Figure 4.7-1.

2) the "greater community" is the City of Boston, and

3) the "region" is the entire Boston Standard Metropolitan Statistical Area

These areas were selected so that trends in the site and surrounding area can be compared to trends occurring in larger areas. No current survey of the social characteristics of the site has been made since it was Harvard University's understanding that only three households would be on the site when all the properties were purchased and that the three owner-occupants would leave their buildings after the sale.

Table 4.7-1 shows the general population characteristics of the other three areas. This table indicates that from 1950 to 1970 there has been a steady decline in the neighborhood's total population (25,002 in 1950; 23,056 in 1960; 20,208 in 1970). This trend is also true for the greater community, though at a decreasing rate. In contrast, the region, as a whole, experienced more than a 16% gain between 1950 and 1970.

During the same time period, 1950 to 1970, the non-white population showed a constant gain throughout the areas examined, with the neighborhood's black population rising more than ten-fold. As a result, the ratio of Negroes to total population increased from 1.2% to 16.8%. The 6.4% increase in the local student population of the educational

N

SCALE
0 1 2 Miles

Figure 4.7-1 1970 Census Tracts Used to Identify the Neighborhood

TABLE 4.7-1

GENERAL POPULATION CHARACTERISTICS(1)

1950 - 1970

Area	Total	Sex		Race			Age			
		Male	Female	White	Non-White	Negro	Under 5	5-19	20-64	65 & Over
Neighborhood										
1950	25,002	10,566	14,436	24,635	367	321	1,991	5,704	14,824	2,483
1960	23,056	9,359	13,697	20,296	2,760	2,487	2,016	6,291	12,051	2,698
1970	20,208	8,274	11,934	16,297	3,911	3,393	1,176	5,411	11,444	2,177
Greater Community										
1950	801,444	388,180	413,264	758,700	42,744	40,057	71,038	160,954	491,818	77,634
1960	697,197	334,707	362,490	628,704	68,493	63,165	66,019	157,467	388,126	85,585
1970	641,071	295,240	345,831	524,709	116,362	104,707	49,927	163,829	345,556	81,759
Region										
1950	2,369,986	1,140,013	1,229,973	2,314,261	55,725	51,568	228,886	487,055	1,422,210	231,835
1960	2,589,301	1,243,163	1,346,138	2,502,209	87,092	77,781	272,346	639,512	1,395,646	281,797
1970	2,753,700	1,303,156	1,450,544	2,602,741	150,959	127,035	218,437	763,819	1,461,559	309,885

institutions shown in Table 4.7-2 reflects the institutional growth in the area.

Table 4.7-3 shows that in the neighborhood and the greater community as a whole, both the number of households and the number of people in the households declined from 1960 to 1970. In census tracts 0809 and 0810 (the latter being the one that contains the site), however, there was an increase in the number of households. In the region, the number of households and the population in the households increased. The net result for the entire area was a population per household decline (from 2.85 in 1960 to 2.36 in 1970, in the neighborhood; 3.23 to 3.09, regionally).

Employment and Local Economy

MASCO has indicated that a majority of current residents of the site are students and hospital employees. However, information on employment or income levels is not available.

The neighborhood's median family income (~$1,900 in 1950; $5,000 in 1960; $7,500 in 1970) has been consistently below that of the greater community ($2,643 in 1950; $5,747 in 1960; $9,133 in 1970) which in turn has been consistently below that of the region ($3,042 in 1950; $6,687 in 1960; $11,449 in 1970). During the period 1950 to 1970, the neighborhood median income has fluctuated in its relationship to the regional median (from 62% in 1950, to 75% in 1960, to 66% in 1970); the greater community's median has dropped from over 85% of that of the region in 1950 and 1960 to less than 80% in 1970.

As shown in Table 4.7-4, approximately the same portion of the neighborhood population earned between $7,000 and $14,999 (41%) in 1970 as did that of the greater community (47%) and the region (48%). However, the neighborhood percentage of families with incomes below $7,000 is substantially greater than that of the region (47% vice 22%) and its percentage of families with incomes above $15,000 is decidedly lower (13% vice 30%). In contrast, the community's distribution is fairly similar to that of the neighborhood's (35% below $7,000; 18% above $15,000).

In 1970, over 95% of the civilian labor force in the areas examined was employed. The neighborhood had more than 60% of its employed people

TABLE 4.7-2

LOCAL STUDENT POPULATION[2]

1968 - 1973

Educational Institution	Number of Students	
	1968	1973
Simmons	2,105	2,804
Wheelock	670	906
Boston State	7,279	10,210
Northeastern	35,619	34,078
Mass. College of Art	580	1,413
Emmanuel	1,533	968
Mass. College of Pharmacology	658	970
Harvard Medical School Harvard School of Public Health Harvard School of Dental Medicine	797	1,061
Total	49,241	52,410

TABLE 4.7-3

HOUSEHOLD CHARACTERISTICS(1)

1960 - 1970

Area	Total Population	Total In Households	Head	Wife	Child	Other Relative*	Non-Relative*	Total In Group Quarters	Persons Per Household	Number of Families	Children Per Family
Neighborhood											
1960	23,056	19,328	6,784	3,130	5,923	2,840	651	3,728	2.85	4,553	1.30
1970	20,208	15,324	6,495	1,921	3,701	1,785	1,422	4,884	2.36	3,114	1.19
Greater Community											
1960	697,197	656,854	224,432	125,895	188,158	101,171	17,198	40,343	2.93	161,729	1.16
1970	641,071	601,725	217,622	102,147	171,081	86,201	24,674	39,346	2.77	140,966	1.21
Region											
1960	2,589,301	2,489,187	770,215	536,302	800,996	333,262	48,412	100,114	3.23	633,941	1.26
1970	2,753,700	2,652,215	859,701	548,738	843,725	340,613	59,438	101,485	3.09	659,745	1.28

*1960 figures were divided between "Other Relative" and "Non-Relative";
1970 figures were divided between "Other Relative" and "Not Related to Head".

TABLE 4.7-4

FAMILY INCOME IN PREVIOUS YEARS(1)

1950 - 1970

Area	1950 Number Reporting	1950 Percent of Total	1960 Number	1960 Percent of Total	1970 Number	1970 Percent of Total
Neighborhood	8,770		4,759		3,230	
Under $2,000	4,310	49.1	620	13.0	208	6.4
$ 2,000 - 3,999	2,970	33.9	1,131	23.8	534	16.5
4,000 - 6,999	1,270	14.5	1,762	37.0	767	23.7
7,000 - 9,999	155	1.8	762	16.0	629	19.5
10,000 or more	65	0.7	484	10.2	1,092	33.8
10,000 - 14,999	N/A		391	8.2	684	21.2
15,000 - 24,999	N/A		80	1.7	352	10.9
25,000 or more	N/A		13	0.3	56	1.7
Greater Community	262,085		164,215		142,019	
Under $2,000	95,345	36.4	15,130	9.2	7,914	5.6
$ 2,000 - 3,999	100,850	38.5	28,485	17.3	14,854	10.5
4,000 - 6,999	50,665	19.3	63,690	38.8	26,228	18.5
7,000 - 9,999	10,100	3.9	34,596	21.1	30,803	21.7
10,000 or more	5,125	2.0	22,314	13.6	62,220	43.8
10,000 - 14,999	N/A		16,869	10.3	36,456	25.7
15,000 - 24,999	N/A		4,428	2.7	20,986	14.8
25,000 or more	N/A		1,017	0.6	4,778	3.3
Region	734,340		640,526		661,650	
Under $2,000	222,955	30.3	38,519	6.0	21,661	3.2
$ 2,000 - 3,999	278,085	37.9	77,899	12.1	39,513	6.0
4,000 - 6,999	169,240	23.0	227,859	35.6	81,297	12.3
7,000 - 9,999	37,145	5.1	159,979	25.0	123,138	18.6
10,000 or more	26,915	3.7	136,270	21.3	396,041	59.9
10,000 - 14,999	N/A		90,769	14.2	196,902	29.8
15,000 - 24,999	N/A		32,431	5.1	148,349	22.4
25,000 or more	N/A		13,070	2.0	50,790	7.7

N/A - Not Available

TABLE 4.7-5

LABOR CHARACTERISTICS BY POSITION OF EMPLOYEE(1)

1970

Area		Total employed civilians (16 Years Old & Over)	Professional Technical, & Kindred Workers	Managers & Administrators, Except Farm	Sales Workers	Clerical & Kindred Workers	Craftsmen, Foremen, & Kindred Workers	Operatives Except Transport	Transport Equipment Operatives	Laborers Except Farm	Farm Workers	Service Workers	Private Household Workers
Census Tract													
1970	1950 & 1960												
0808	S2	694	175	17	23	133	39	106	12	55	-	128	6
0809	S6	1,685	468	53	58	415	121	96	36	65	-	370	3
0810	S5	2,502	791	93	98	634	174	117	46	105	-	419	25
0811	S4	1,312	303	69	43	288	65	82	29	36	-	370	27
0103	S1	2,248	662	121	74	623	95	88	17	41	-	506	21
Neighborhood		8,441	2,399 (28.4)	353 (4.2)	296 (3.5)	2,093 (24.8)	494 (5.9)	489 (5.8)	140 (1.7)	302 (3.6)	- (-)	1,793 (21.2)	82 (1.0)
Greater Community		266,505	44,894 (16.8)	15,035 (5.6)	15,073 (5.7)	71,655 (26.9)	27,157 (10.2)	27,895 (10.5)	8,800 (3.3)	11,031 (4.1)	277 (0.1)	42,683 (16.0)	2,005 (0.8)
Region		1,136,474	227,092 (20.0)	101,886 (9.0)	87,754 (7.7)	260,400 (22.9)	131,593 (11.6)	112,089 (9.9)	32,978 (2.9)	36,964 (3.2)	2,458 (0.2)	135,299 (11.9)	8,231 (0.7)

(1) The number in parentheses represents the percentage the above figure is of the total in the area.

in white collar occupations as shown in Table 4.7-5. Almost half of these were in the professional and technical category, and about 40% in clerical positions. Blue collar workers, most of whom were operatives and skilled craftsmen, constituted less than 20% of the labor force. Most of the remaining employed people were within the "service category".

Within these three broad breakdowns, the neighborhood shares a fairly similar pattern with the greater community and the region. However, when viewed more specifically, the neighborhood is distinctly different in terms of the percentage of professional and technical workers (~30% professional in the neighborhood, ~20% in the greater community and the region). In 1960 there was a larger percentage of professionals in the neighborhood than in the greater community, however, the difference was not as acute (16.4% vice 11.6%).

In terms of the industry of the employer, shown in Table 4.7-6, nearly half (44.8%) of the neighborhood's employed residents work in the fields of health and educational services. Less than 10% work within the manufacturing sector. Comparable statistics for the greater community are 18.7% and 17.5%, respectively; and 17.3% and 22.4% for the region.

Within the immediate vicinity of the proposed project is one of the largest concentration of jobs found anywhere in the city. Over 20,000 jobs are currently provided by the nearby medical and educational institutions. Table 4.7-7 shows a breakdown of the job base by institution.

On the basis of a 1972 market survey, performed by Robert Gladstone and Associates,[2] some generalizations can be made concerning this institutional employment sector. The Gladstone report estimates that approximately 33% of all medical jobs consist of physicians, nurses, and technicians; about 10% are in the higher administrative positions; and over 55% are in the service and support categories. Within the educational institutions, the breakdown is less clear. Some 32% represent faculty positions, while the remaining 68% are divided between professional and non-professional support. In terms of salaries received, the report indicates that approximately 40% of all medical and educational employees earn less than $6,500 a year, 20% are between $6,500 and $12,000, and the remaining 40% have salaries above $12,000.

TABLE 4.7-6

LABOR CHARACTERISTICS BY INDUSTRY OF EMPLOYER[1]

1970

	Neighborhood		Greater Community		Region	
	Number	Percent	Number	Percent	Number	Percent
Civilian Labor Force (16 years old and over)	8,849		278,607		1,184,595	
Employed	8,441	95.4	266,505	95.7	1,136,474	95.9
Unemployed	408	4.6	12,102	4.3	48,121	4.1
Total Employed	8,441		266,505		1,136,474	
Construction	187	2.2	11,730	4.4	56,998	5.0
Manufacturing	776	9.2	46,646	17.5	254,546	22.4
Transportation	178	2.1	10,599	4.0	37,158	3.3
Communications & Utilities	151	1.8	9,568	3.6	37,759	3.3
Wholesale Trade	144	1.7	11,410	4.3	54,623	4.8
Retail Trade	1,017	12.0	40,283	15.1	183,934	16.2
Finance, Insurance, Realty	504	6.0	24,479	9.2	85,417	7.5
Business and Repair Service	257	3.0	10,166	3.8	41,457	3.6
Personal Services	252	3.0	11,544	4.3	39,219	3.5
Health Services	2,295	27.2	26,965	10.1	87,267	7.7
Educational Service	1,483	17.6	22,870	8.6	108,907	9.6
Other Professional	728	8.6	17,848	6.7	68,004	6.0
Public Administration	344	4.1	19,366	7.3	66,881	5.9
Other Industry	125	1.5	3,031	1.1	14,304	1.3

TABLE 4.7-7

ESTIMATED INSTITUTIONAL EMPLOYMENT[3]

Medical Institutions (1974)	Employment
Harvard Medical School	2,123
Harvard School of Public Health	457
Harvard School of Dental Medicine	313
New England Deaconess Hospital	2,000
Children's Hospital	3,200
Peter Bent Brigham Hospital	2,022
Robert Breck Brigham Hospital	362
Beth Israel Hospital	2,800
Boston Hospital for Women	1,046
New England Baptist Hospital	902
Joslin Diabetes Clinic	180
Children's Cancer Research Foundation	260
Sub-Total	15,665
Educational Institutions (1968)	
Simmons	506
Wheelock	175
Boston State	670
Northeastern	2,621
Mass. College of Art	98
Emmanuel	330
Mass. College of Pharmacology	96
Sub-Total	4,496
TOTAL	20,161

There are also an estimated 300 jobs associated with the principal commercial facilities located within walking distance of the site. These activities are primarily situated along Huntington and Brookline Avenues including the area around Brigham Circle. Among the commercial facilities found are those which provide meats and groceries, dry cleaning services, pharmaceutical and medical supplies, clothing, liquor, gifts and sundries. In addition, there are banks, barbershops, bars, coffee shops, restaurants, and small specialized stores, including those which provide keys and locks, jewelry, hi-fi equipment, and shoe repair.

On the site there are jobs associated with Children's Hospital. Details have not been gathered, since these jobs will be relocated within the medical area when the site is developed. There is also a dentist's office which provides some employment. There are no manufacturing or retail businesses on the block.

Revenues to Local Government

The City of Boston receives 63% of its total revenues through the property tax. In 1974, the total assessed valuation of the city was $1,742,000,000 and the total tax levy was $342,690,740. The 1974 tax rate is $196.70 per thousand dollars of assessed valuation. Property on the site has a current assessed value of $302,000. At the 1974 tax rate, the site provides $59,403 in taxes to the City of Boston. Some of the properties on the site are not carried on the tax rolls because they are owned and used by institutions and are tax exempt.

Housing

The local housing stock is characterized by a low incidence of home-ownership; a low vacancy rate; advanced age; a deteriorating physical condition; and a low housing value. There are nearly 2,000 low and moderate income households in the community, which are unable to meet the economic costs of sound housing. There are also some 8,000 persons associated with the nearby medical and educational institutions who are presently capable of supporting semi-luxury and luxury type accomodations, but because of their under supply, these people are not attracted to the community. This naturally creates the family income lag previously discussed.

The 1970 Census reported that less than 4% of the neighborhood's (the neighborhood, as previously defined, includes 5 census tracts) year-round housing stock lacked full plumbing facilities, and less than 8% of its occupied dwellings were overcrowded. In spite of these statistics, there is reason to believe that housing quality in the neighborhood is actually poorer than the Census data indicates. The majority of housing on the site is vacant and boarded up. The three buildings facing Francis Street appear to be in good condition and buildings along Brookline Avenue have been suffering from neglect.

The neighborhood's housing quality is negatively influenced by a variety of factors. Since most of the housing in the area is renter occupied, the burden of maintenance rests with the building owner, who is often an absentee landlord. Moreover, almost 65% of the dwelling units were constructed before 1939; thus, the advanced age of much of the housing stock requires that periodic maintenance programs be undertaken in order to prevent deterioration. On the other hand, the introduction of rent control in 1970, and, more recently, climbing interest rates and fuel costs have acted as an economic disincentive toward property and building maintenance. As a result, landlords have generally postponed rehabilitation and improvement programs indefinitely, allowing their buildings to physically deteriorate. The block bounded by Francis, Fenwood, Vining and Huntington Streets is undergoing renovation to upgrade the housing condition in the more immediate project area.

Median values of owner-occupied dwellings in the neighborhood have failed to keep pace with the greater community. Between 1960 and 1970, Boston's median value increased by 45%, from $13,500 to $19,600. During this same period, values in the neighborhood rose only 37%, from $11,900 to $16,300. As a result, residential values in the neighborhood average 17% less than those found elsewhere in the greater community. In 1960, they were only 12% less. Rents, on the other hand, have increased at a far greater rate in the neighborhood than citywide. Much of this increase may be attributed to the excessive demand placed upon the local housing supply by the increasing student population. In 1960, the City's average rent was $78, fourteen dollars more than the neighborhood's average. Between 1960 and 1970, the median rent in the neighborhood rose 65.6%, whereas those in Boston increased by 25.6%. The net

result was that by 1970, the average rent in the neighborhood was $106, eight dollars more than the citywide average.

Community Perceptions

Discussions were held with area residents in order to obtain some general concerns of the community. This was not intended to be a survey or public opinion poll, but to reflect the thoughts of the people living near the project area toward their community. It is based upon discussions, in November and December 1974, between ERT and 20 individuals who hold offices in the many community organizations, concerned residents with skilled professions and a variety of others residing in the community. A site specific analysis of perceptions of the proposed facility could not be undertaken as data pertaining to residents and abutters of the site is not available. It should be noted that this area of Boston has been subjected to a great deal of institutional development in recent years and, as such, general attitudes have evolved which tend to lump all projects together.

The leaders see their community as basically working class, with a number of citizens on welfare. There is an unclear picture concerning what portion of the residents are employed by the institutions (estimates range from 3 to 50%) but there is agreement that those who do work within them are predominately unskilled or semi-skilled.

The major religion is Catholic; but other religions, as well as atheism, do coexist without conflict. The people seem to be quite aware of the ethnic divisions in their community (i.e. White Irish Catholic, Black and Spanish), but other divisions, such as economic or social, seem to have little importance. The residents all consider the community stable except for the transient student and nurse portion of the population. This stability, however, is defined as second and third generation by the Irish and as 2 or 3 years by the Spanish.

Most of the community organizations are felt to be oriented toward maintaining the residential character of the neighborhood. The Roxbury Tenants of Harvard (RTH) is a source of much pride, looked at as "the forerunner of the tenant movement in the country". The Back of the Hill Community Development Association serves a comparable function for

its portion of Mission Hill. There is also the Mission Hill Main and the Mission Hill Extension Task Force as well as the Puerto Ricans United working within the existing housing projects. There are block groups such as the Delle Avenue Neighborhood Association concentrating on their target areas. In April of 1974, the Mission Hill Planning Commission was established in an effort to serve as a representative voice for all of the components of Mission Hill. The Neighborhood Housing Service seeks to help individual homeowners borrow money to upgrade a home. The Mission Hill Health Movement is attempting to focus attention on the inability of the neighborhood to obtain primary health care in a community surrounded by hospitals and doctors. LaRaza Marcha is the Spanish speaking community's organization for community matters; "health, welfare, education, housing - you name it. We have it." All of these organizations are seen by members of the community as basically cooperative with one another but without adequate recognition from the city government.

The major social issue with which the community is concerned is the institutional expansion which the people believe is changing the family-based character of Mission Hill. They feel that institutions in general, and Harvard in particular, have acted with a selfish lack of consideration for the residents.

Another area of concern is the apparent lack of basic health care for those not involved in the Harvard Community Health Plan. There is no longer a private practicing physician in the community and most people seem to prefer to wait until things reach emergency status before succumbing to seeking assistance from any of the local hospitals. The Hispanic community regards their situation as even further handicapped by the institutions' lack of effort to provide bilingual personnel to assist those with an inadequate command of English.

Many residents of Mission Hill appear quite willing to take action in order to improve local conditions. There are those who will do research to document possible prejudicies or call or write the appropriate officials and others who would take more activist approaches. These issues have been basically the same for some time, but now there is a growing social awareness of them.

Traffic is viewed as a distinct problem in terms of both the volume passing through the community with its incumbent noise and air pollution and the inadequate residential parking. One resident mentioned that "we actually had a gun battle over a parking space," and others voiced the sentiment that, "Commuters interrupt peaceful living."

People are anxious about the kind of education their children are receiving and consider busing an irritant and possibly a coverup. Public transportation, while convenient in terms of location, is regarded as overcrowded and dirty. Except for complaints about inadequate water pressure, utilities are viewed as well-functioning, but costly. Phone service is seen as slow and probably outmoded.

Several large businesses were cited as being unwilling to deliver in the community. The bulk of the local business community is viewed as being comprised of people who do not live in Mission Hill and whose only interest in the community is in terms of profit. Reference was made to a past attempt to organize these businesses which apparently created friction and was never really viable. Those businesses which are locally owned or operated are seen as personal and cooperative. They too fear the institutional encroachment and would like to see improvement in the quality of life and a positive change in Mission Hill.

The relationship between the community and the institutions, is regarded by members of the community contacted as quite poor and is considered to be one of the major negative aspects of living in this area. What they see as continued encroachment, the deteriorating condition of many of the institutionally-owned homes, and the unwillingness of these institutions to communicate with them contribute to their resentment.

People find a real sense of community in Mission Hill. They value not just their immediate families but their homes and the community as a whole. There exists a good deal of pride and a feeling of belonging. This "magnetism", is what they like best about their community.

MASCO in the Community

The Medical Area Service Corporation has been formed to provide overall planning for the medical institutions in this area of Boston. It has been coordinating planning for land use development, traffic

circulation, parking, utilities, incineration, and distribution of supplies. This overall planning has been undertaken to help control and direct institutional activities for better operating efficiencies and to avoid conflicts with the community.

Harvard University, as a member of MASCO, has been a major influence in the project area and in Mission Hill, south of Huntington Avenue, having purchased considerable quantities of real estate. Harvard in the past few years has been trying to coordinate its development of institutional, academic and other services with the community. A public statement issued on April 30, 1974, contained in Appendix F of this report, explained Harvard's development plans for the area and presented the University's intent of no more land acquisition south of Huntington Avenue after December 21, 1970.

During the past year, Harvard has begun refurbishing the 30 multifamily homes in the block between Francis Street and Fenwood Road extending from Vining Street to Huntington Avenue. This work entails both interior and exterior rehabilitation.

The most significant work of Harvard University has been its participation in the 774 unit Mission Park Housing Development to be constructed in the area of the Vining Street parking lot. It has been Harvard's financial backing that has made that project possible. In that project's development, Harvard has worked with the Roxbury Tenants of Harvard organization (RTH) in funding, relocations, and the establishment of the corporation that will actually own the development and in coordinating that project with other projects planned for the area. The working arrangement between RTH and Harvard is presented in a memorandum of understanding contained in Appendix G. Coordinating activities have included site selection for the total energy plant and site selection and time schedule for the proposed service center. It has also been planned that the total energy plant will supply the Mission Park Development with hot water and incineration service.

References for 4.7 Social and Economic Characteristics

1. U.S. Department of Commerce Bureau of the Census, Housing and General Social and Economic Characteristics for 1950, 1960 and 1970.

2. 1968 figures are from Robert E. Gladstone & Associates, Market Findings and Recommendations: Harvard Convent Site, prepared for Building Systems International, April 17, 1972.

   1973 figures are from personal communications with each of the institutions.

3. 1968 figures are from National Center for Educational Statistics.

   1974 figures are from American Hospital Association.

4.8 Land Use

This subsection discusses existing land use patterns as they relate to the site, the surrounding blocks, and to the larger project area. Figures 4.8-1 and 4.8-2 represent land use maps for these spatial areas of investigation. The information contained on these maps is based upon a 1973 Boston Redevelopment Authority land use survey and upon field checks by Environmental Research & Technology.

Land Use, Ownership of the Site and Dislodgment of Tenants

Seven major structures are currently located on the proposed site, of which five are in residential use and two are occupied by institutional activities. All of the buildings were built in the early part of this century and may be characterized as being three stories in height and constructed of bricks. All of the structures appear to have well-maintained exteriors with the exception of the eight row-houses situated along the Brookline Avenue side. These are in only fair to poor condition, with six out of the eight attached sections vacant and boarded up.

Figure 4.8-1 Land Uses: Site and Surrounding Area

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760393

Figure 4.8-2 Land Uses in the Project Area

Four buildings are along the Francis Street side of the site. Three of these buildings are detached rowhouses, separated by narrow alleyways. These former single-family dwellings have long ago been converted into apartment units. Together, these three buildings contain 47 apartments and 20 single rooms. Private parking for fifteen to twenty vehicles is located in the rear with access provided through an alley which connects Francis and Peabody Streets. The fourth structure on the Francis Street side of the proposed site is called the Faxon Building and serves as an annex to the Children's Hospital Medical Center. This building currently houses two out-patient clinics. The top floor of this two and one-half story structure is occupied by a maternal and infant health program and a family health care program uses the ground floor. Directly adjacent to the Binney Street side of this building is a paved parking area reserved for employees of the two health programs. To the rear of the Faxon Building, at the corner of Peabody and Binney Streets, is a three-story building which also belongs to Children's Hospital and serves as its business offices.

The remaining two buildings on the site are both residential rowhouses. The three-story attached dwelling facing Peabody Street is a series of six single-family homes, each with a small private backyard. The Brookline Avenue side of the proposed site contains the other set of rowhouses. This residential structure has eight entranceways with only the two end units being occupied; each section could contain two or three dwelling units. The middle sections are vacant and boarded up. Small private yards are at the rear of the dwellings.

In planning for the total energy plant, Harvard University has completed site assembly and has either purchased or agreed to purchase all of the site except for the end rowhouse along Brookline Avenue at the corner of Peabody Street. All negotiations for these buildings have been done on the open market. Arrangements are being made for the transfer to Harvard of the properties on the site owned by other institutions.

Harvard has been negotiating with the owner for the sale of the remaining piece of residential property that is occupied solely by the owner, but no agreement has been reached at this time. Nevertheless, the project has been designed based on the use of the entire site for

optimum plant arrangement. Since Harvard may not be able to buy this last piece of property, an alternative building arrangement around that property is being developed. This is discussed as a building design alternative in Section 7.5 of this report.

At the time Harvard purchased the Francis Street buildings only 30 apartments and 5 rooms of the 47 apartments and 20 single rooms in the building were occupied. The previous owner indicated that he was in the process of converting the buildings into a Medical-Dental complex. (See a letter in Appendix H from Harvard's real estate agent to MASCO.) The occupants of the building became tenants of Harvard upon the sale of the building, some of which are under written leases and all tenancies are subject to termination on 30 days notice. Occupants of five of the apartments are students who have notified Harvard that they intend to leave at the end of the current school year.

In order to ensure timely site availability for demolition, notices have been sent to all the occupants terminating their occupancy as of May 31, 1975. To facilitate transitions, Harvard will accept other termination dates and will refund security deposits if any in advance so they can be used as deposits on other apartments.

Institutional activities on the site will be relocated within the medical area. It is expected that the single rowhouses would be left vacant by the owners upon the sale of the buildings.

Land Uses Surrounding the Site

Properties adjacent to the site include the following:

1) Sidney Farber Cancer Center Redstone Laboratory and the Fredrika Home, a privately owned home for the aged along Peabody Street.

2) House of the Good Samaritan, part of Children's Hospital along Binney Street.

3) Residential dwellings along Francis Street.

4) Commercial establishments along Brookline Avenue.

Figure 4.8-1 illustrates the land uses found in the nine block area immediately surrounding the proposed site. This area is primarily institutional; the major institutions represented in this section include the Sidney Farber Cancer Center, New England Deaconess Hospital, Joslin Clinic, Children's Hospital, Peter Bent Brigham Hospital and the Frederika Home. At the corner of Deaconess Street and Pilgrim Road is Harris Hall, a dormitory for New England Deaconess Hospital's student nurses. Almost all of the off-street parking facilities shown on Figure 4.8-1 are used mainly by institutional personnel and/or patients. Few spaces are available for general public parking.

The only completely non-institutional use blocks in the area surrounding the proposed site are those which lie south of the site between Francis Street and Fenwood Road. These blocks contain institutionally owned numerous three-story wood frame houses in addition to a small neighborhood playground. This latter activity represents one of three public recreation/open space areas located in the vicinity of the proposed site. The other two include a portion of the Olmsted Park system which lies south of the Riverway and Joslin Park, a narrow open space strip situated between Joslin and Deaconess Roads.

Some commercial activities also take place in the area, but are generally limited to locations along either Brookline or Longwood Avenues. The commercial strip situated directly across from the proposed site on Brookline Avenue contains a gas station, an automobile dealership, a restaurant, cheese shop, laundromat, pizza shop, liquor store, clothing

store, and a bank. Further north along Brookline Avenue is a smaller commercial area which is occupied by a women's clothing store, drug store, florist and assorted commercial offices. Brigham Circle at the corner of Huntington Avenue and Tremont Street contains another commercial area. The Children's Hospital Medical Center Complex is the major commercial activity taking place along Longwood Avenue. This contemporary structure contains a travel agency, restaurant, co-op, and medical offices in addition to a surgical supply store, barbershop, bank and motel. The only other commercial/industrial activity of significant size is the existing power plant located at the corner of Blackfan and Children's Roads.

Figure 4.8-2 illustrates general land use patterns as they presently exist within the larger project area which is defined by the Riverway, the Fenway, Ruggles Street, and Huntington Avenue. This map graphically shows the predominance of institutional land uses occurring within the project area. For purposes of simplicity, this map aggregates institutional residences and parking facilities under the category, "institutional and related activities." Figure 4.8-3 breaks down these institutional land uses according to three functional categories: health, education, and other. Health related activities are generally concentrated south of Longwood Avenue whereas educational activities tend to be located north of this roadway.

Applicable Zoning Regulations

Figure 4.8-4 illustrates the zoning districts which have control over the site and the surrounding area. Table 4.8-1 indicates the applicable dimensional requirements associated with each of the zoning districts. Both Figure 4.8-4 and Table 4.8-1 are derived from the City of Boston's Zoning Code and Enabling Act as amended through November 30, 1973.

The proposed site lies within two zoning districts, residential H-3 and business L-1. Under both the residential H-3 and business L-1 designations, there are no minimum lot size, width or building height restrictions for allowable uses other than dwellings. The maximum floor area ratio is 3.0 within a residential H-3 district and 1.0 under a business L-1 district.

Figure 4.8-3 Institutional Land Uses in the Project Area

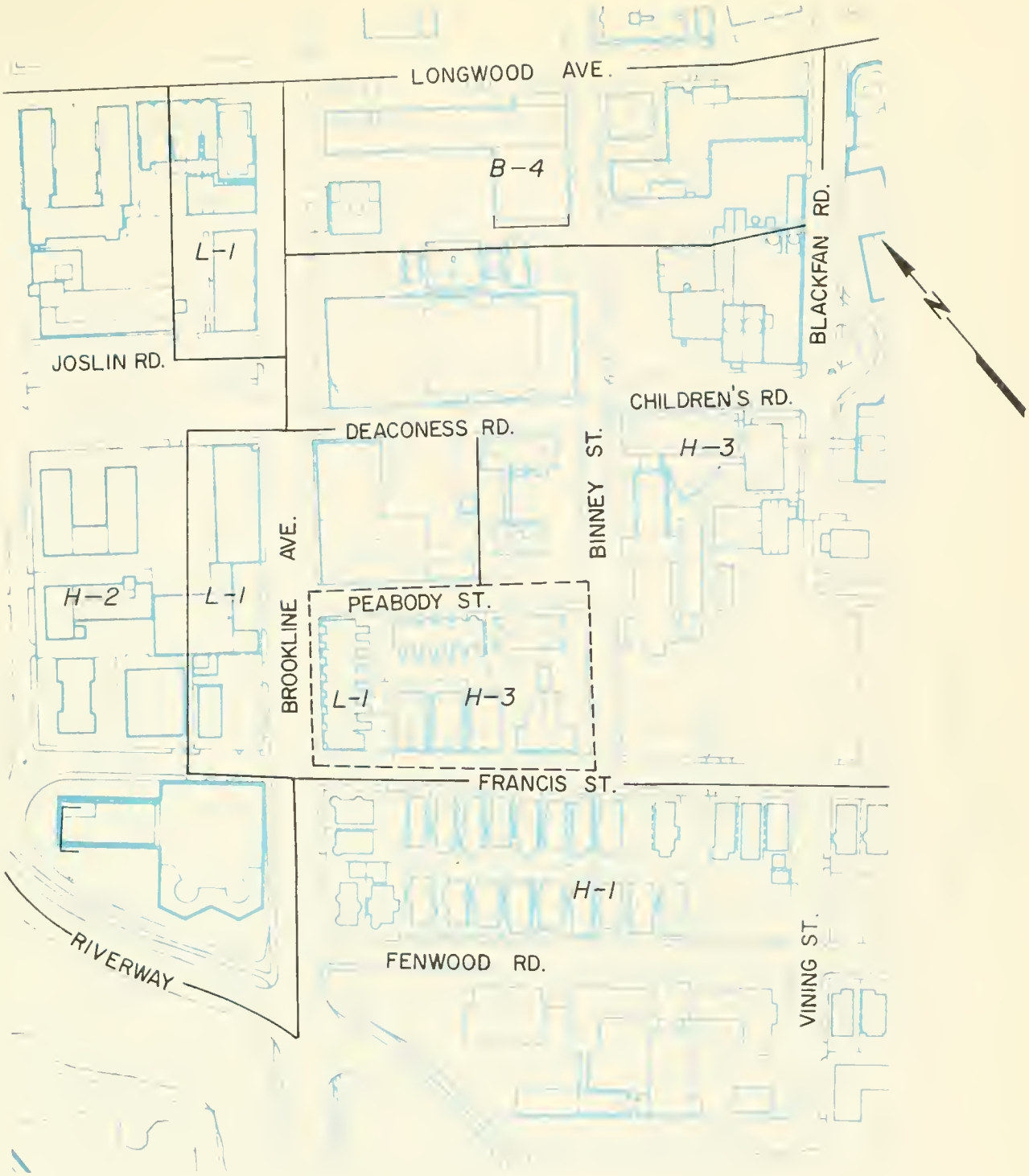

Figure 4.8-4 Zoning Map of the Site and Surrounding Area

TABLE 4.8-1

DIMENSIONAL REGULATIONS

DISTRICT	TYPE OF USE	LOT SIZE minimum sq. ft.	LOT AREA minimum sq.ft. for each add'l. dwell. unit	LOT WIDTH minimum feet	FLOOR AREA RATIO maximum (1)	HEIGHT OF BUILDINGS maximum stories	feet	USABLE OPEN SPACE minimum sq.ft. per dwell.unit	FRONT YARD minimum depth feet	SIDE YARD minimum width feet	REAR YARD minimum depth feet	SETBACK OF PARAPET minimum distance from lot line	REAR YARD maximum % occup. by accessory buildings
RESIDENCE DISTRICTS													
R-1	1 & 2 family row	2,000	1,500	none	1.0	none	none	400	20	(4)	$10 + \frac{30_L}{(6)^{20}}$	$\frac{H + L'}{6}$ for all uses	25
	Any other dwelling	5,000	1,000	50	1.0	none	none	400	20	(4)			25
	Other use	5,000	1,000	50	1.0	none	none	none	25	(4)			25
R-2	Any dwelling	none	none	none	2.0	none	none	150	20	(4)	$10 + \frac{L}{(6)^{20}}$	$\frac{H + L'}{6}$ for all uses	30
	Other use	none	none	none	2.0	none	none	none	20	(4)			30
R-3	Any dwelling	none	none	none	3.0	none	none	100	15	(4)	$10 + \frac{L}{(6)^{20}}$	$\frac{H + L'}{6}$ for all uses	35
	Other use	none	none	none	3.0	none	none	none	15	(4)			35
BUSINESS DISTRICTS													
C-1	Any dwelling	(3)	(3)	(3)	1.0	3	35	(3)	(3)	(3)	(3)	none	-
	Other use	none	none	none	1.0	3	35	none	10	none(5)	30(7)	none	-
C-1	Any dwelling	(3)	(3)	(3)	1.0	3	40	(3)	(3)	(3)	(3)	$\frac{H + L'}{6}$ for all uses	-
	Other use	none	none	none	1.0	3	40	none	none	none(5)	$10 + \frac{L}{20}$(7)		-
C-4	Any dwelling	(3)	(3)	(3)	4.0	none	none	(3)	(3)	(3)	(3)	$\frac{H + L'}{6}$ for all uses	-
	Other use	none	none	none	4.0	none	none	none	none	none(5)	$10 + \frac{L}{20}$(7)		-

Key: L = Length of wall parallel (or within 45° of parallel) to lot line, measured parallel to lot line.
H = Height of building above the height below which no setback is required.
L' = Length of wall parallel (or within 45° of parallel) to lot line, measured parallel to lot line at greatest length above the height below which no setback is required.

(1) See Sections 15-3 and 15-4 for cases where maximum floor area ratio may be exceeded.
(2) No additional lot area for first 30 dwelling units.
(3) See Section 13-4.
(4) Ten feet plus one twentieth of the length of the wall parallel (or within 45° of parallel) to the side lot line. See further Section 19-4.
(5) See Section 19-5.
(6) See Section 20-4.
(7) See Section 20-5.
(8) See second paragraph of Section 18-2.
(9) 70 feet maximum at parapet line facing a street (excluding a public alley); height to top of roof may be 90 feet provided that for every foot of height over 70 feet, a setback of 6 inches is provided from the front parapet line. Mechanical equipment shall be set back from the front parapet line an additional one foot for every foot in height of such equipment.
(10) 20 feet on east-west streets, none on north-south streets. A bay window, as defined in Section 2-1, may protrude into a front yard, Section 18-1 notwithstanding. See also Sections 18-1 and 18-2.
(11) See Section 16-4.
(12) See Section 16-5.

(‡ As amended on April 14, 1967, Feb. 17, 1971, March 20, 1972, July 9 and Sept. 27, 1973.)

Five different zoning districts control the area surrounding the proposed site. With the exception of the area to the south of Francis Street, those blocks directly adjacent to the site are either classified as a residential H-3 district or as a business L-1 district. The adjacent blocks which lie south of Francis Street, however, fall under either the residential H-1 or H-2 designation.

Current Construction & Proposed Development

Figure 4.8-5 indicates areas within the project area where construction activity is currently taking place and where development proposals exist.

Current Construction

1) Sidney Farber Cancer Center - 150 bed cancer research and treatment facility with a 600 person staff in addition to a 200 car institutional garage. Phase 1 occupancy involves 50 staff persons and is expected to occur late in the summer of 1975. Final completion and total occupancy is estimated to occur later in 1976.

2) Joslin Howard F. Root Wing - Addition of a 4-story patient and research facility with commercial footage along Brookline Avenue. Completion expected in 1976.

3) New England Deaconess Hospital Radiation Facility - 7-story laboratory to be completed in 1976 - seven stories above grade, five below.

4) Rehabilitated Housing - Harvard University is currently in the process of upgrading housing units which it owns. This project is expected to be completed in 1975.

5) Children's Hospital Entrance Pavillion - This facility is already partially occupied. Final completion of the pavillion is expected in 1975.

6) Beth Israel Feldberg Addition - Planned for completion in 1976. This facility will have 176 beds.

Figure 4.8-5 Current Construction and Proposed Development of the Site and Surrounding Area

7) Boston State Library - 12-story addition containing a cafeteria, library and educational facilities slated for completion in 1975.

8) New England Deaconess School of Nursing - New England Deaconess Hospital is constructing an 8-story building which is to provide educational and residential facilities for 200 student nurses. The structure is expected to be completed in 1976.

Proposed Development

1) Affiliated Hospitals Center - 14-story hospital combining Robert Breck Brigham, Peter Bent Brigham and Boston Hospital for Women. Will be under construction for about 5 years starting in the fall of 1975.

2) MASCO Service Center - A warehouse and parking garage are planned for construction after portions of the Mission Park Housing Project are complete. It will be located south of the energy plant on the block bounded by Francis, Vining, Fenwood and Brookline Avenue.

3) Existing Energy Plant - This site is to be transferred to Children's Hospital after completion of the new plant. No firm plans have been established concerning the reuse of this site.

4) Mission Park Housing - 774 units of mixed income housing, 42,000 sq. ft. of commercial space, and an underground garage proposed for this 13.7 acre site.

5) Seeley G. Mudd Biochemical Laboratory - Harvard University is planning the construction of the biochemical laboratory to begin in the spring of 1975.

6) Boston State General Building - Future plans for Boston State include the demolition of North and Collins Hall and the subsequent construction of an 8-story general administrative office facility. This is likely to occur upon completion of its library addition.

7) Boston State Parking Garage - A 1000 car garage may be constructed on this site.

8) Simmons College Addition - Simmons College is planning the construction of an addition to its central wing in addition to renovations of its main building. The date of this activity is uncertain.

9) New England Deaconess Garage Extension - Possible 140 car addition to the hospital's existing garage is contemplated to begin in summer 1975 and end in 1976.

Community Facilities and Services

Police and Fire Protection for the area presently is provided through assignments in "Sector II" whose boundaries extend from Francis Street to the Riverway, the Fenway, Forsyth Street (by the Museum of Fine Arts), across Huntington Avenue on Forsyth Street (through Northeastern University), the Penn Central train tracks, Prentiss Street, Parker Street, Ward Street, Huntington Avenue, to Francis Street. "Sector II" is patrolled regularly by a police vehicle with two officers, and at periodic intervals by a foot patrolman in the Brigham Circle area and by an officer on motorcycle cruising the Tremont Street area. A district substation is currently located on Tremont Street near Roxbury Crossing, although, due to the effectiveness of the "911" emergency call system, serious consideration is being given to phasing out this station.

The site is located within the Boston Fire Department's Division #2, Fire District #5. Call Box #2376 at Huntington and Parking Hill Avenues and Call Box #2363 at Huntington and Longwood Avenues are the most proximal to the project area. The following equipment responds to any alarm generated from these sites:

INITIAL ALARM

Engine	Location
#37	Huntington Avenue and Ruggles Street
#14	Center Street, Roxbury
Lighting Plant	
# 2	Huntington Avenue and Ruggles Street

WORKING FIRE

Engine	Location
#28	Center Street, Jamaica Plain
#42	Columbus Avenue, Roxbury
#33	Boylston Street, Back Bay
#22	Tremont Street and West Brookline

Each subsequent alarm results in the arrival of four additional engine units. When any alarm is sounded, equipment shifts occur throughout the city to maintain adequate coverage at every station. Supplementary services are provided by: #2 Rescue Vehicle at Blue Hill Avenue, Dorchester; a special service unit at Dudley Street, Roxbury; and the Division #2 Deputy Chief, stationed at Columbus Avenue.

The water supply for five fighting operations which runs under Huntington Avenue maintains adequate flow and pressure for fire fighting operations within the area. The main has a static pressure of 55 psi, and is rated at "low service" (a range of 40-60 psi), as compared to "hi-service" (60-90 psi), and "extra hi-service" (70-120 psi) found in the high value or downtown sectors of the city.

Medical Facilities

The Faxon Building on the site contains a maternal and infant health program and a family health care program. The surrounding area also contains seven medical institutions and two neighborhood health

centers, offering 24-hour medical service to the local community and greater Boston. The American Hospital Association lists the following bed capacities for the in-patient facilities in 1974:

Hospital	# Beds
New England Deaconess	476
Children's Hospital	343
Peter Bent Brigham Hospital	330
Robert Breck Brigham	96
Beth Israel	374
Boston Hospital for Women	262
New England Baptist Hospital	250
TOTAL Inpatient Capacity	2,131

Emergency services provided at the various hospitals include general, pediatric, maternity and dental care at Beth Israel; general, pediatric and dental at Children's; general care at New England Deaconess; and general, and dental attention at Peter Bent Brigham. A full range of outpatient clinics and services are likewise available at several of the hospitals to the extent indicated in Table 4.8-2.

The Longwood Center of Health, Inc., located at 332 Longwood Avenue offers unrestricted services in community health care during the Monday through Saturday clinic hours. Services include: gynecology, pediatrics , obstetrics, adult medicine, dental services, mental health, family planning, and nutritional guidance. Twenty-four hour coverage is available on call. The Mission Hill-Parker Hill Center/Harvard Community Health Plan at 1579 Tremont Street provides total health services onsite in pediatrics, adult medicine, nutrition, home care, and social service. Gynecology, obstetrics, dental services, mental health, alcoholism, eye screening, and family planning; "key" services are furnished at the Kenmore Square facility, where twenty-four hour coverage is maintained.

Three nursing homes are also incorporated within or near the project area. A long-term bed capacity of fifty persons is provided by the Tudor House Nursing Home at 81 South Huntington Avenue, a 61 bed capacity exists at the Frederika Home at 65 Deaconess Road, and the Huntington Nursing Home at 20 Parker Hill Avenue accomodates 27 persons.

TABLE 4.8-2

OUTPATIENT CLINICS AND SERVICES

MISSION HILL AREA

	Beth Israel	Boston Hosp/ Women	Children's	New England Deaconess	Peter B. Brigham	Robert B Brigham
Clinics						
Allergy	✓		✓		✓	
Dermatology	✓		✓		✓	
Ear, Nose, Throat	✓		✓		✓	
Eye	✓		✓		✓	
Gen. Med. & Surgery	✓		✓	✓	✓	
Gynecology	✓				✓	
Mental Retardation	✓		✓			
Obstetrics	✓	✓				
Orthopedics	✓		✓		✓	✓
Pediatrics	✓		✓	✓		
Podiatry	✓				✓	
Services						
Abortion	✓	✓			✓	
Alcoholism	✓				✓	
Blood Test	✓					
Dental	✓			(P)*	(P)*	
Drugs	✓				✓	
Family Planning	✓	✓			✓	
Hearing Tests	✓		✓		✓	
Immunizations	✓					
Mental Health	✓		✓		(P)*	
Nutrition	✓		✓		✓	
Physical Exams	✓					
TB	✓				✓	
VD	✓	✓	✓		✓	
Social Services	✓		✓		✓	✓

*(P) = Partial Service Only

Educational Facilities

Current public school assignments by district for the children within and near the project area are: 1) at the high school level, Boston English High with an estimated capacity of 2,500 - 1974 enrollment of 2,359; 2) at the middle school level, the Thomas Edison Middle School with an existing capacity of 786 - 1974 enrollment of 841; 3) at the elementary school level, the Tobin School and Annex, and the Farragut School with a combined capacity of 1,242 - 1974 enrollment of 1,008. The enrollments and capacities are shown in Tables 4.8-3 and 4.8-4.

Children in the community also attend parochial and other private schools, most notably the Mission Church School on Tremont Street. The Winsor School, a private institution, is also located nearby on Brookline Avenue.

Higher education, adult education, and trade school opportunities are excellent with numerous institutions located within or close to the project area; many of them are readily accessible by public transportation. These include:

- Northeastern University
- Boston State College
- Simmons College
- Massachusetts College of Art
- Emmanuel College
- Wheelock College
- Hebrew College
- Boston Trade School for Boys
- Boston High School for Girls
- Harvard University Medical School, School of Dental Medicine, and School of Public Health
- Massachusetts College of Pharmacy
- Museum of Fine Arts School
- Wentworth Institute

TABLE 4.8-3

Enrollment, September, 1974* PUBLIC SCHOOL ENROLLMENT

School District	Grade	Black	White	Oriental	Spanish Black	Spanish White	Indian Amer.	Other Non-White	No Data	Total By Grade
English High	(9)	301	317		19	77		3	14	731
	(10)	278	217	2	15	73		6	11	602
	(11)	250	222	2	5	14		2	6	501
	(12)	200	271	5	8	32	1	3	5	525
	Total	1,029	1,027	9	47	196	1	14	36	2,359
Thomas Edison	(5)	1	1							2
	(6)	109	176	19	5	48			5	362
	(7)	75	110	9	10	27		4	6	241
	(8)	95	90	8	4	33		2	1	233
	No Grade	1							2	3
	Total	281	377	36	19	108		6	14	841
Tobin	(k1)								42	42
	(k2)								79	79
	(01)	98	6	33	1	15			16	169
	(02)	92	8		1	41			32	174
	(03)	88	8	1	4	45			24	170
	(04)	123	12	1	7	44			31	218
	(05)	104	8		4	39			1	156
	Total	505	42	35	17	184			225	1,008

* Projected - Summer, 1974

NOTE: Boston Latin, which is in the project area, does not draw from any particular school district since its student body is based on an entrance exam. Its current enrollment for grades 7 through 12 is 1,952.

TABLE 4.8-4

PUBLIC AND PRIVATE SCHOOL ENROLLMENT

I. Enrollments for Boston Public Schools as Compared With the Combined Enrollments of Private and Parochial Schools in Boston: (for K-5) Kindergarten - 5th Grade

From: Mass. State Fall Reports

	Enrollment			
	1973	1972	1971	1970
Public	93,301	95,151	96,067	96,239
Private and Parochial	24,896	26,759	28,580	29,967
% Public	78.9%	78.1	77.1	76.3
Total Enrollment	118,197	121,910	124,647	126,206

II. Capacity Estimates for Study Area Schools as Determined by 1971-72 Survey

Elementary	Farragut:	308	
	Tobin + Tobin Annex:	934	1,242
Middle	Edison:	786	
High	English:	2,000*	

* "This school opened new in 1974, could just as easily justify a figure of 2,500."

Enrollment and Capacity Adjacent School District

	Capacity	Enrollment
Elementary (James Hennigan)	1,100	920
Middle (Mary Curley)	1,082	1,250

Open Space and Recreation

No recreational facilities nor public open spaces are presently contained within the proposed site boundaries. Within the adjacent neighborhood is found a playlot at the corner of Fenwood Road and Vining Street, and a greenbelt stretch between Joslin Road and Deaconess Road. The playlot facility is surfaced with asphalt, covered in part by sand piles, and equipped with swings and slides. Quality of maintenance is only considered to be "fair" primarily due to excessive littering.

Several additional active and passive recreational facilities are available within the larger project area. The Muddy River and its contiguous 40 acres of parkland constitutes the largest region of open space near the project area. However, poor maintenance and poor water quality inhibits the use and enjoyment of the Muddy River for recreational activities.(1) A medium incindence level of criminal activity and vandalism, an extensive rat population, an inadequate path system, and park furniture found to be in varying stages of disrepair further detract from a potentially healthy, natural environment. Also within the project area is a three-lot playground on the east side of Kempton Street and an asphalt basketball court on the west side of Kempton. Both facilities are fairly well maintained, although some swing seats and basketball nets are currently missing. The Farragut School playground, at Huntington Avenue and Fenwood Road provides an asphalt-surfaced play area.

Neighborhood Services

There are no churches, public libraries or neighborhood employment or service centers within the project area.

Transportation

The medical center area is a heavily-trafficked area and, according to a report by Wilbur Smith and Associates:(2)

> "It is estimated that approximately 22,000 persons visit the medical center area on an average weekday. Of these, approximately 11,000 are anticipated to be automobile drivers. Nearly, 70 percent of all persons with business in the Medical center area appear to approach and depart the area from

the west, northwest, and southwest, and approximately 30 percent of persons arrive at the area from locations predominantly to the east of the area."

Circulation Patterns

The Riverway, Brookline Avenue and Huntington Avenue serve mainly as arterial commuter routes, as well as a means of access to the local institutions. Traffic studies undertaken by Charles Hilgenhurst Associates/Wilbur Smith Associates[2] indicate that 1) traffic demands on these routes are in excess of the capacity of the roadways, and 2) that deviations from standardized traffic patterns are caused by the traffic generation characteristics of the institutions in the area as well. In addition to typical peaks at morning and evening rush hours the hourly traffic variations indicate substantial traffic loads at those hours when institutional work shifts change. As a result of the normal excessive traffic demand plus the institutional influence, the pair of arteries and to some extent the Riverway, are subject to peak, or near peak volumes from before 7 AM until 7 PM. Hourly traffic variation on Brookline Avenue is indicated in Figure 4.8-6 and is based on traffic counts taken on Brookline Avenue just south of the intersection with Longwood Avenue. This traffic burden is most evident in congestion of the arterials, queuing of traffic volumes (which often spills over to the local and connector streets as well), and in reduced traveling speeds. The following figures illustrate the congestion patterns that exist in the medical area. Figure 4.8-7 shows that during afternoon peak periods, queuing occurs along Brookline Avenue, Longwood Avenue and Huntington Avenue. Travel speeds throughout the network at peak periods also illustrate the efficiency and operational characteristics of a network. Figure 4.8-8 illustrates travel speeds observed throughout the medical center area and adjacent highways during the peak PM traffic hour. This figure shows that travel speeds in the Francis Street/Fenwood Road area are often greater than 20 miles per hour, which is more than adequate for circulation purposes and is somewhat excessive for residential streets. However, on Brookline Avenue, speeds are often extremely low (10 to 15 mph) between Longwood Avenue and the Riverway. On Longwood Avenue itself, speeds experienced are within the range of 10 to 15 mph. In the Fenway area and on Avenue Louis Pasteur, speeds are again often over 20 mph.

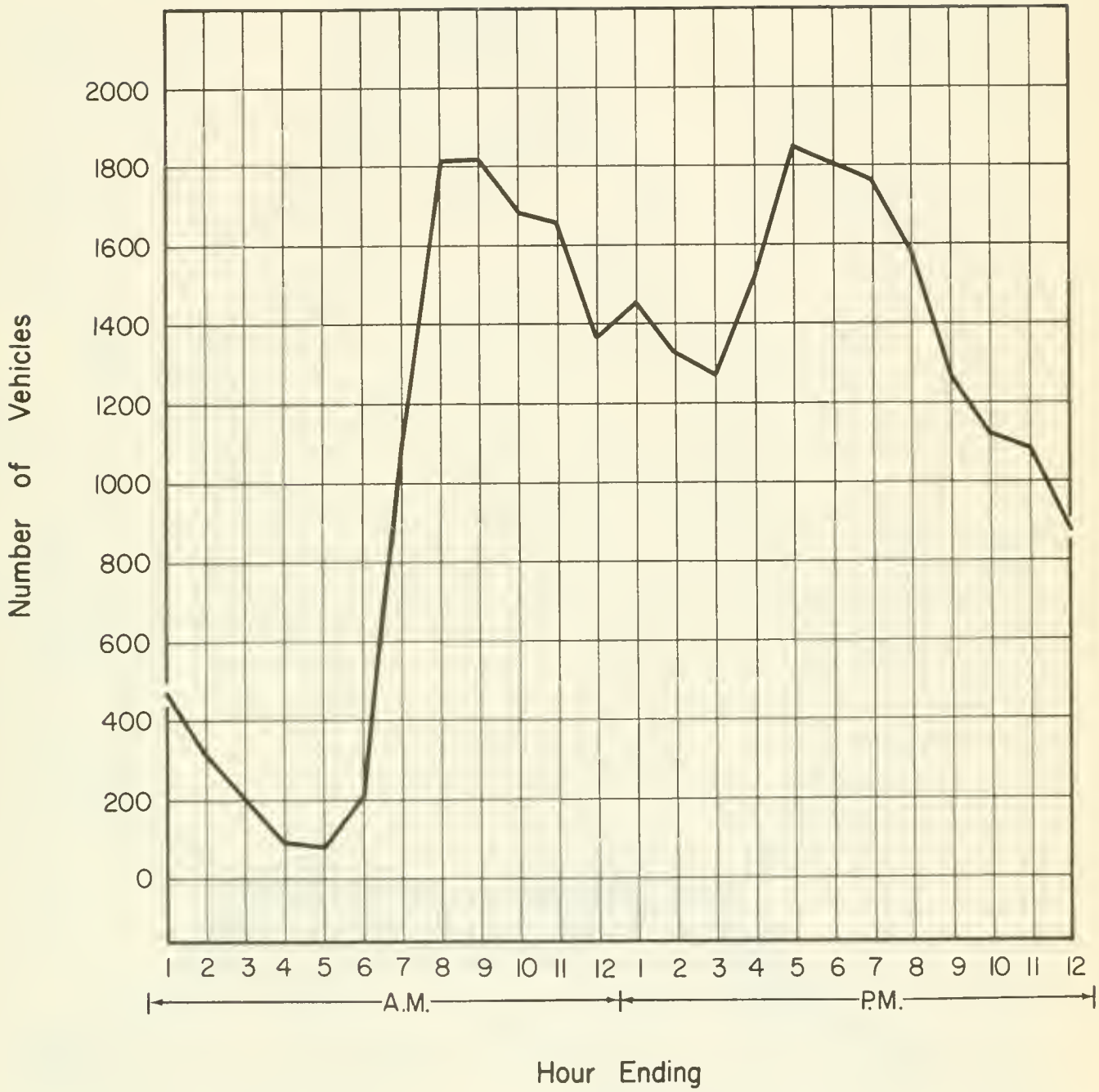

Figure 4.8-6 Hourly Traffic Variation on Brookline Avenue

750218

Figure 4.8-7 Vehicle Queuing During Weekday Afternoon Periods

750219a

Figure 4.8-8 Average Travel Speeds Observed During the Peak Afternoon Traffic Hour

Peak-hour traffic volumes are another measure of the existing characteristics of the street system. Traffic volumes on major streets in the vicinity of the proposed site are shown for both the AM and PM peak-hours in Figures 4.8-9 and 4.8-10.

The principal congestion locations are summarized as follows:

"1) Intersections on Brookline Avenue, particularly that with Longwood Avenue

2) The intersection of Longwood Avenue and the Riverway

3) The Boylston Street, Brookline Avenue, Fenway intersection

4) Huntington Avenue, particularly at the intersections with Longwood Avenue and Francis Street

5) Parker Hill Avenue, particularly at the intersection with Huntington Avenue."(2)

There are several projects in the medical area which have the potential to affect local traffic volumes and circulation patterns by the time construction would begin on the total energy plant. Some of the proposed construction would cause variations due to increases in workers and construction deliveries. The most significant variable would be the Mission Park project which would close the Vining Street parking lot and temporarily relocate parking in lots one or two miles from the medical center. The short-term elimination of approximately 1680 cars from this lot would reduce traffic volumes in the medical area. Estimates of the associated reductions in traffic volumes have been prepared by Wilbur Smith and Associates, Inc. and these reductions are displayed in Figure 4.8-11 for both the AM and PM peak hours.

Parking Supply

There are approximately 5,000 parking spaces in the off-street and private street locations in the medical center area. Parking demand at the present time, due to the medical center facilities, has been estimated by Wilbur Smith and Associates to be approximately 5,900 spaces. When compared to effective supply (reduction from number of physical

Figure 4.8-9 Existing Traffic Volumes During the Peak Afternoon Traffic Hour

Figure 4.8-10 Existing Traffic Volumes During the Peak Morning Traffic Hour

Figure 4.8-11 Percentage Reductions in Peak Hour Traffic Volumes Due to the Closing of the Vining Street Lot

750432

spaces to account for poorly parked vehicles and allowance for vehicle maneuvers during peak activity periods), this present deficiency is estimated at approximately 1,400 spaces. Major parking facilities in the project area are shown in Figure 4.8-12.

Future changes anticipated in parking supplies are listed in Table 4.8-5. The largest decrease is due to closing the existing Vining Street lot, which will be replaced by an underground facility of approximately 1,275 spaces and 366 surface parking in the residential area of the Mission Park Housing Complex. Of the 1,275 spaces in the garage, 895 are to be reserved for institutional use.

Table 4.8-5 indicates a small net decrease in parking supply, however, the impact of removing existing parking for expansion projects before replacement parking is available is of particular concern. Without a major shift to public transportation, and greater enforcement of curb parking restrictions, local curb parking, already a problem, will be further aggrevated.

1) Medical area employees currently use "remote lots" such as Vining Street, and rely upon the shuttle bus service; adequate shuttle bus service from even more remote lots should not increase the present level of inconvenience significantly.

2) Adequate enforcement programs by responsible city departments can help to ensure the reservation of local street parking positions for residents and other short-term parking. A more drastic measure (but one used with success in Cambridge) is resident-only parking streets, signed, with rigorous enforcement. Both residents and institutions in the area have discussed such programs with the city.

Public Transportation

Public transportation serving the medical area includes two trolley lines and four bus lines. These routes, which are indicated on Figure 4.8-13 include:

Figure 4.8-12 Major Parking Facilities and Planned Lot Closings

750332

TABLE 4.8-5

STATUS OF MAJOR PLANNED CHANGES IN
INSTITUTIONAL OFF-STREET PARKING SUPPLY

	Item	Status	Institutional Anticipated Net Change in Number of Space
General Planning & Development:			
1.	Opening temporary lot by Peter Bent Brigham Hospital at Roxbury Crossing*	Planned	+ 550
2.	Closing lot by Peter Bent Brigham Hospital and Good Samaritan Lot	Planned	- 236
3.	Closing Vining Street lot	Planned for spring 1975	-1,680
4.	Opening garage in Dana Building by Sidney Farber Cancer Center	Planned for early 1975	+ 190
5.	Mission Park (garage)	Planned for 1977	+ 895
6.	MASCO Service Center	Planned for 1979	+ 700

* Temporary - to be closed after completion of MASCO Service Center Garage

Figure 4.8-13 Public Transportation Servicing the Medical Area

- Riverside Trolley line, which provides service from North Station, Boston outbound through Brookline and Newton to Route 128.
- Arborway Trolley Line, which provides service from Park Street, outbound along Huntington Avenue and South Huntington Avenue to Forest Hills.
- Bus Route Number 47, which provides service from Kenmore Square to Boston City Hospital along Brookline, Longwood, and Huntington Avenues.
- Bus Route Number 60, which provides service from Kenmore Square to Chestnut Hill along Brookline Avenue and Boylston Street.
- Bus Route 65, which provides services from Kenmore Square to Brighton Center along Brookline Avenue and Washington Street.
- Bus Route 66, which provides service between Union Square in Allston and Dudley Station in Roxbury.

During peak commuter hours, the demand exceeds this design capacity of this Arborway Trolley Line along Huntington Avenue. The quality of service can be considered poor, largely due to obsolete equipment and the lack of reliable scheduling.

Visual Environment

The area consists of an amalgam of older wood-frame and brick residential buildings and older and modern institutional buildings. There are no unique visual attractions in this area. ERT considers that the Faxon building is the most attractive building on the site. It is a two and one-half story, turn of the century brick building originally used as a school building. Granite details and the iron entrance gates add to its attractiveness and character.

The appearance of structures in the project area are best described by photographs of different views. Figures 4.8-14, 15 and 16 show views of the site, from the site and some nearby land uses. Each of these figures contains a small map indicating the location and orientation of the view.

1 *Faxon Building & Housing on Francis Street*

2 *Row Houses Along Brookline Ave.*

3 *Looking South Along Brookline Ave.*

4 *The Children's Hospital Business Offices & Row Houses Along Peabody Street*

6 *Parking Area & Rear Yards in The Center of The Site*

5 *The Alley Connecting Peabody & Francis Streets*

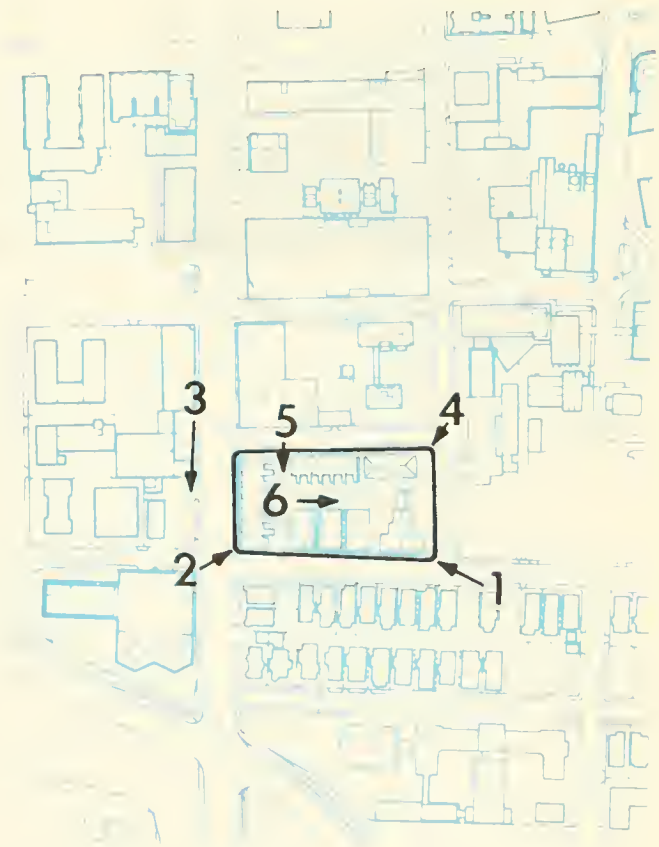

Figure 4.8-14 Views of the Site

- Riverside Trolley line, which provides service from North Station, Boston outbound through Brookline and Newton to Route 128.
- Arborway Trolley Line, which provides service from Park Street, outbound along Huntington Avenue and South Huntington Avenue to Forest Hills.
- Bus Route Number 47, which provides service from Kenmore Square to Boston City Hospital along Brookline, Longwood, and Huntington Avenues.
- Bus Route Number 60, which provides service from Kenmore Square to Chestnut Hill along Brookline Avenue and Boylston Street.
- Bus Route 65, which provides services from Kenmore Square to Brighton Center along Brookline Avenue and Washington Street.
- Bus Route 66, which provides service between Union Square in Allston and Dudley Station in Roxbury.

During peak commuter hours, the demand exceeds this design capacity of this Arborway Trolley Line along Huntington Avenue. The quality of service can be considered poor, largely due to obsolete equipment and the lack of reliable scheduling.

Visual Environment

The area consists of an amalgam of older wood-frame and brick residential buildings and older and modern institutional buildings. There are no unique visual attractions in this area. ERT considers that the Faxon building is the most attractive building on the site. It is a two and one-half story, turn of the century brick building originally used as a school building. Granite details and the iron entrance gates add to its attractiveness and character.

The appearance of structures in the project area are best described by photographs of different views. Figures 4.8-14, 15 and 16 show views of the site, from the site and some nearby land uses. Each of these figures contains a small map indicating the location and orientation of the view.

1 *Faxon Building & Housing on Francis Street*

2 *Row Houses Along Brookline Ave.*

3 *Looking South Along Brookline Ave.*

4 *The Children's Hospital Business Offices & Row Houses Along Peabody Street*

6 *Parking Area & Rear Yards in The Center of The Site*

5 *The Alley Connecting Peabody & Francis Streets*

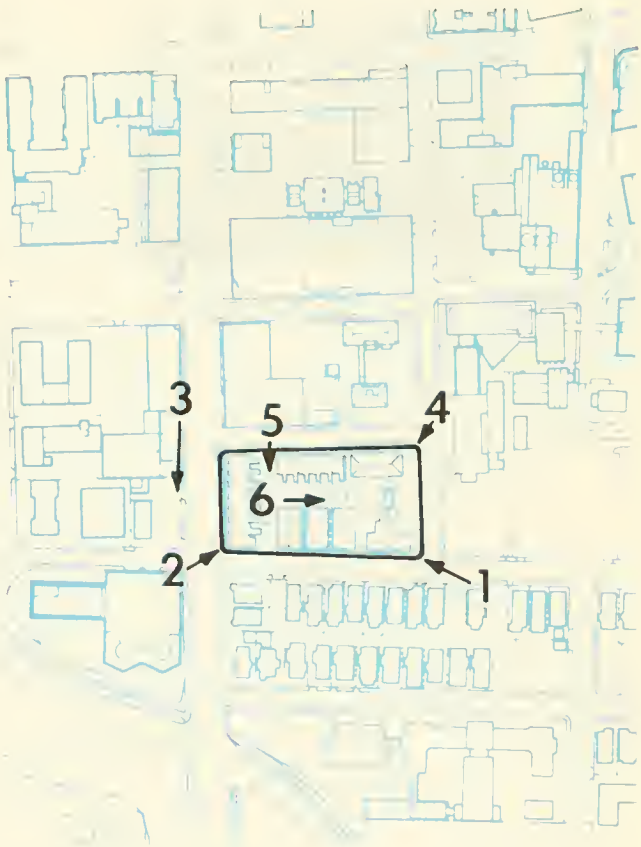

Figure 4.8-14 Views of the Site

1 *Olmsted Park & New England Deaconess Hospital - Parking Garage & Offices*

2 *The Frederika Home*

3 *Children's Hospital - House of the Good Semaritan*

4 *3 to 4 Story Residential Structures on Francis Street*

5 *Commercial Area Along Brookline Ave.*

Figure 4.8-15 Views from the Site

750319 750318

1 *The Existing Energy Plant*

2 *Housing & Open Space Along Fenwood Road*

3a *Looking South Towards The Site Along Brookline Ave.*

3b *Looking North Along Brookline Ave.*

4 *New England Deaconess Complex & Joslin Foundation Inc.'s New Construction*

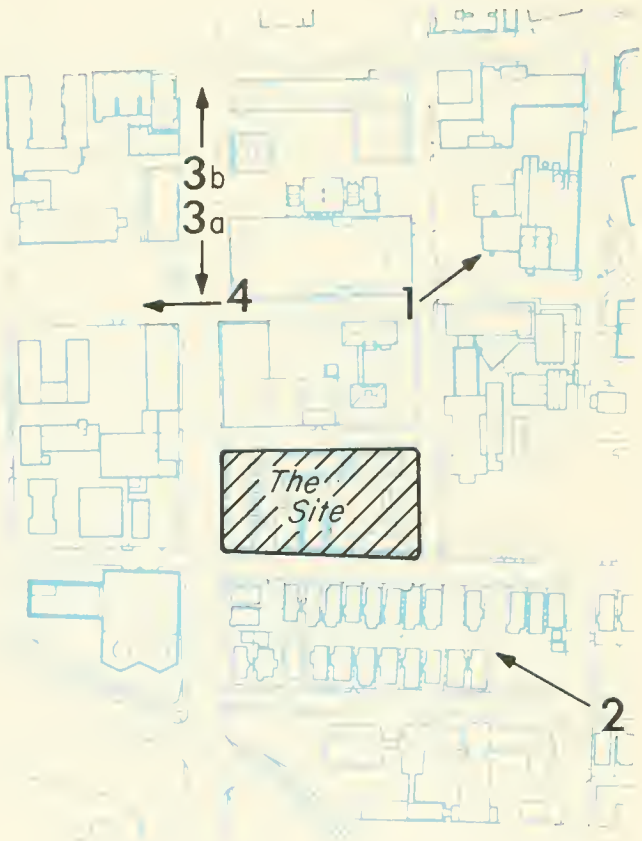

Figure 4.8-16 Views of the Surrounding Area

Historical Sites and Structures

The Olmsted Park System is included in the National Registry of Historic Places.[3] This park was designed by Fredrick Law Olmsted in the mid-1800's in order to provide recreational open space within the city. There is also a 1729 marker indicating distance to Boston in the brick wall that runs parallel to Huntington Avenue between the Riverway and Kempton Street. This is also listed in the registry. There are no historic structures on the project site.

Architectural, Archaeological and Scenic Significance

There are no buildings in the project area that are listed in the National Register of Historic Places.[3] However, the Faxon building does represent an example of turn of the century school house architecture. Although its use has changed several times since its original construction, the exterior has remained relatively unaltered with the exception of several small additions that have been placed at the rear of the building.

The site has been judged to be of no archaeological significance because of its previous allocation for urban use.

This area has no unique natural scenic attraction.[4]

References for 4.8 Land Use

1. Olmsted Park System Study, Interim Summary of Findings.

2. MASCO Traffic and Parking - Preliminary Macro-Assessment of Traffic and Parking Problems, Wilbur Smith Associates, December 1974.

3. National Register of Historic Places 1969, U.S. Department of the Interior, National Park Service Washington, D.C. Updated Portions Titled Additions, Deletions, and Corrections in Federal Registers through September 3, 1974.

4. National Register of Natural Landmarks, Federal Register, January 27, 1972.

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5. PROBABLE IMPACT OF THE PROPOSED PROJECT ON THE ENVIRONMENT

This section describes the environmental impacts expected from the proposed project. Since there are two stages of the project that affect the environment, construction and operation have been considered separately.

5.1 Construction

5.1.1 General Description of Construction Activities

The power plant is to be built on the block bounded by Brookline Avenue, Francis Street, Binney Street and Peabody Street and will include Peabody Street. It will occupy about 1.25 acres of the 1.4 acre site; the remaining area will be used for MASCO offices. The total construction period, from the start of demolition to the start of plant operation, will extend for approximately two and a half years. After about one year from the start of demolition the building shell will be in place and the remaining work will be conducted inside. The timetable of activities is summarized in Figure 5.1.1-1.

The initial phase of construction activities will be the demolition of the existing on-site structures. Approximately 2,000 cubic yards of debris will be carted away in 20 cubic yard trucks. Demolition, which will last about two months will include the use of a crane with a wrecking ball and clam shell plus several bulldozers. This work can proceed from the interior of the block which will allow the disposal trucks to be accommodated on site. The demolition phase of the construction work will be done by an outside contractor whose responsibility it will be to dispose of the debris. This debris will probably be partially recycled, or dumped in a land fill. Specifications will be included in the contract to control generation of fugitive dust by standard practices.

Once the site is cleared, the building contractor will erect a chain link or plywood fence around the periphery of the site for security;

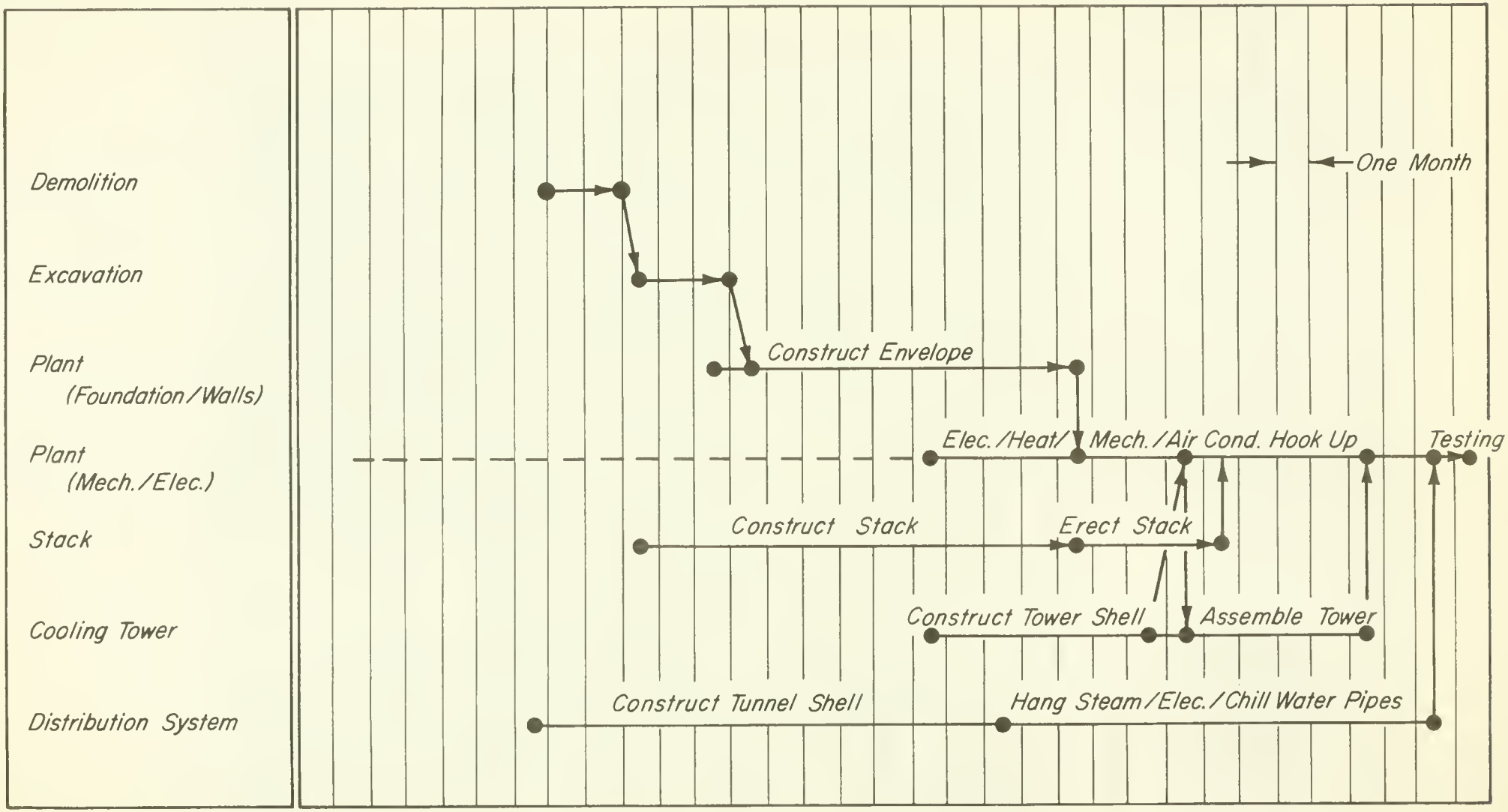

Figure 5.1.1-1 Timetable of Construction Activities

then excavation will begin. This work will probably be subcontracted by the building contractor and will take place in steps over two months. An estimated 25,000 cubic yards of excavated material will be removed in 12 cubic yard trucks. The average number of truck trips to haul the fill will be about 60 per day and will be scheduled so that the number of trucks waiting to be filled at the site will be minimized.

There will probably be one backhoe plus a front-end loader in use during excavation. This equipment decision, however, will be made by the contractor. Ramping will probably be employed to permit the loading of trucks on site. This ramping would also facilitate equipment deliveries and concrete deliveries directly from trucks as opposed to cranes with buckets or pumping.

During excavation, no dewatering is anticipated because the excavated area will be above the water table. The main plant lower floor will be at elevation 24 and the oil tank area will be down to elevation 16. This is above the water table which occurs at elevation 11. However, surface water will be controlled to keep the site free of water. Surface water will collect in a sump pit and will then be pumped to a storm drain.

It is not anticipated that extensive pile driving will be required. In order to hold the slopes along the sides of the site soldier piles and lagging may be used. Soldier piles are H beams that are placed in pre-augered holes spaced on ten foot centers and then driven a distance of about ten feet. As excavation proceeds wooden lagging is inserted between the soldier piles. This type of pile driving would take place for about four hours per day over a one-month period. Sheet driving may be necessary along Binney Street and 30 feet along Francis Street. This sheeting is steel plate that must be driven its entire length into the ground. If this is required, and it will depend on detailed geological analysis in that area of the site, it would take about one month. No blasting will be required during any phase of construction.

The building foundation will be made of reinforced concrete and will consist of spread footings laid out to form a checkerboard pattern with a slab on grade between them. Additional footings will be placed under the location of the heavy equipment. Approximately 3,000 cubic yards of concrete will be used for foundations and walls and pouring

will be intermittent over an eight month period. Because of weight restrictions on trucks, the legal limit for concrete deliveries is about 7 cubic yards per truck. On some days there may be multiple pourings requiring ten to twenty trucks, usually all in the morning. An average figure, however, will be three trucks per day.

Equipment deliveries will start toward the end of the pouring of the foundation slab. Two of the diesel engines are scheduled for delivery in the winter of 1976, two more engines are to be delivered in the spring of 1976 and the last two in the summer of 1976. The back-pressure turbine will probably be delivered in the winter of 1977. Chillers and boilers are scheduled for delivery in the winter of 1976. No equipment will be brought to the site unless it is possible to put it in place at that time. Shipment to the site may occur in the early morning hours to avoid creating traffic problems.

Steel erection will begin prior to the pouring of the walls and will take place over a period of about six months. Approximately 300 to 400 tons of steel will be used in the structure. Deliveries will require about 40 truck movements at a rate of about 5 trucks per day.

There is no space on site for worker parking except for key supervisory personnel. Off-site parking areas and transportation to the site will be provided for construction workers. It is anticipated that there will be sufficient staging area on-site for most of the construction activities; however, special provisions may be required during installation of the cooling towers and construction of the stack. Plans for these installations have not yet been finalized.

The hours of construction will be from 7:00 to 8:00 AM to 4:00 PM, and no unloading is anticipated during off hours. Utility connections will be coordinated with the individual utilities and the appropriate city agencies. It is expected that temporary service interruptions will occur when connections are made to water and electric lines. On-site sanitation facilities for workers will either be connected to the city sanitary drains or will consist of chemical toilets.

The distribution network construction will occur simultaneously with the power plant construction but will continue for only one and a half to two years.

This work involves opening surface coverings with jack hammers and saws and excavating with a back hoe. The hole will be approximately 15 feet wide and from 15 to 25 feet deep depending upon terrain, geology and obstructions that must be avoided. Work will progress continuously in sections 20 to 50 feet in length. It is estimated that a 50-foot linear excavation will require removing 700 cubic yards of material from the area in 12 cubic yard trucks. Some material may be left in the area for backfilling or it may be brought in when it is needed. The sides of the excavation will be supported with a lateral support system as necessary. After work hours the work area will be marked with barricades and lights and will be covered in areas having high vehicular traffic use.

The final routing of this distribution tunnel has not yet been decided. Its location will be dependent on obstacles such as major underground utility services and available right of way to minimize disturbances. Possible routes are shown in Figure 3.5-6. Street crossings will be done in stages to permit traffic flow. Temporary interruptions of gas and water service may be necessary as connections are made to move the utilities from the construction area. These interruptions should not last more than a few hours because all necessary preparations will be made for rerouting before service is interrupted.

The tunnel itself will be a cast-in-place concrete box with either a precast or poured roof. It is estimated that 2 cubic yards of concrete will be required per linear foot of tunnel and it will be delivered in 7 cubic yard capacity trucks. Some of the internal distribution system piping will be placed in the tunnel before pouring is complete. As sections of tunnel are completed, the lumber used in the forms will be removed for reuse, the open area will be backfilled and the surface area will be restored.

Estimates of manpower requirements for both the distribution network construction and the power plant construction are displayed in Figure 5.1.1-2. The lower graph represents those workers associated with the construction of the distribution network which will be located primarily along Binney Street and Longwood Avenue. The upper graph represents those workers at the power plant site, itself.

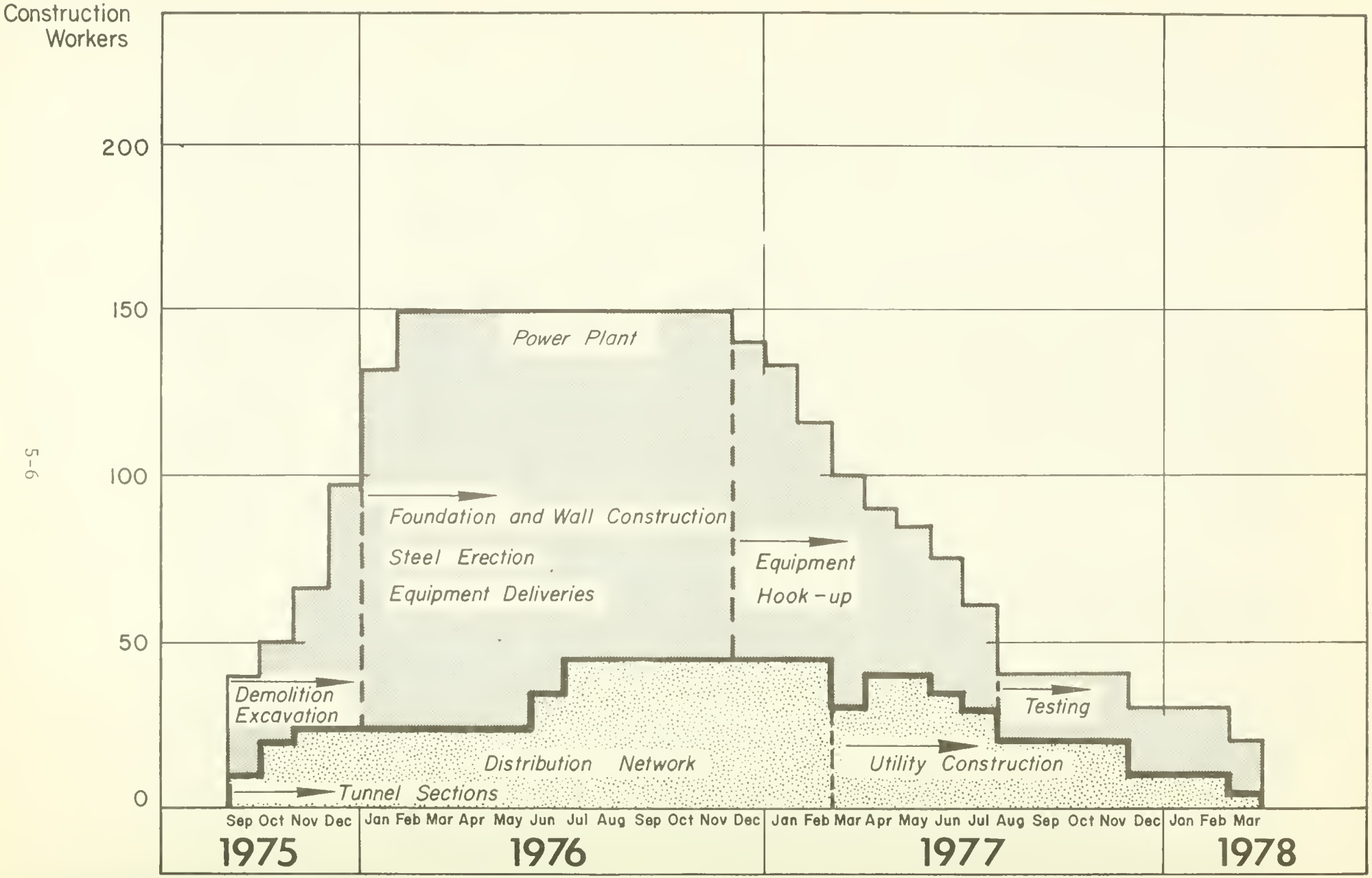

Figure 5.1.1-2 Manpower Requirements During Construction Period

5.1.2 Air Quality

Fugitive Dust

Demolition, excavation and movement of materials to and from the site will increase ambient concentrations of particulates in the local area. The amount of dust that will become airborne cannot be determined because it will vary with the amount of material moved, the method of handling and the wind. Keeping the area damp, covering truck loads and using gravel in areas of truck movements will minimize the amount of dust produced.

Emissions from Construction Trucks

Carbon monoxide, hydrocarbons and photochemical oxidants will be the main air contaminants emitted from the construction equipment. Of these contaminants carbon monoxide is one that is of most concern since concentrations are directly dependent upon emissions from individual sources. Hydrocarbon and photochemical oxidant standards are part of an overall control strategy to reduce emissions over a wide area since photochemical reaction does not take place instantly. In order to evaluate the effect of the construction trucks which would be the greatest source of CO, their emissions have been compared to emissions from other vehicles near the site. Table 5.1.2-1 presents the CO emission rates in grams per mile for automobiles, heavy duty gasoline powered trucks and diesel trucks calculated by the method described in Appendix C. These emitted per meter of road length per second, for the mixture of cars and trucks in the medical area. These values are shown in Table 5.1.2-2 along with the maximum line source emission that would be produced by a truck volume of 10 diesels per hour with 5 trucks idling at the site. This comparison indicates that less than 8% of the current CO source strength on Brookline Avenue could be added by construction trucks directly. An 8% increase in CO should not cause the estimated 1-hour and 8-hour background levels of 8.6 ppm and 6.1 ppm, respectively, to exceed the 1-hour standard of 35 ppm or the 8-hour standard of 9 ppm.

Table 5.1.2-2 also shows the effect of an increased number of idling vehicles along Brookline Avenue if truck movements from the site cause a traffic delay. The overall increase in CO emission rates under this condition and the construction related truck activity could be up to 55%, which could cause CO standards to be exceeded. This effect, if it occurs, can be minimized by planning truck movements and traffic controls to reduce traffic congestion.

Impact of Construction Workers' Vehicles

The manpower schedule presented in Section 5.1.1 indicates that about 200 workers will be employed on the site during 1976. Since remote off-site parking areas will be used for construction workers, there should be no significant impact on carbon monoxide levels in the project area. A conservative approach to estimating carbon monoxide levels from construction workers assumes that they all drive to the site. Under this condition the impact is small.

Since the work hours of these workers would be staggered from normal work hours the peak hourly traffic rates and 1-hour CO concentration through the area would not be increased by more than one or two percent. The duration of the peak traffic flow rate would be broadened, however, with the net effect that the 8-hour CO levels on the side streets servicing the Medical Area would be increased approximately in proportion to the percentage increase in automobile visits to the area.

Section 4.8 shows that approximately 11,000 cars travel through the medical area daily. If the additional construction workers all drive automobiles, the 8-hour peak CO concentrations on the side streets could be expected to increase by about 2%. Since existing 8-hour CO levels are estimated to be 6.2 ppm, 70% of the 9 ppm standard, a 2% increase due to the influx of 200 additional construction workers would, therefore, not be likely to create any critical impact.

5.1.3 Hydrology

The major potential water quantity impact associated with the construction phase involves an increase of storm water infiltration through

TABLE 5.1.2-1

ESTIMATED 1975 VEHICULAR CO EMISSION RATES
IN THE MEDICAL AREA

Source Type	20 mph* CO Emission Rate (gm/mi)	Idling** CO Emission Rate (gm/min/veh)
Mixture of: 97% Automobiles 1.5% Diesels 1.5% Heavy Duty Gasoline Vehicles	48.7	8.85
Mixture of Diesel Truck Mixture	20.4	2.65
Mixture of Heavy Duty Gasoline Powered Vehicles	13.3	53.2

* These values may be converted to a line source emission in mg/m-sec by multiplying by the ratio

$$\frac{\text{vehicles/hr}}{5.8 \times 10^3}$$

** These values may be converted to a line source emission in mg/m-sec by multiplying by the ratio

$$\frac{16.7\ (\text{vehicles/lanes})}{\text{reference length}}$$

where

reference length is the length of roadway that is likely to experience a representative mixture of idling vehicles.

TABLE 5.1.2-2

CO LINE SOURCE EMISSION RATES FOR BROOKLINE AVENUE

ADJACENT TO THE SITE

Traffic Conditions	Estimate of Current Emission Rate Including Idling Traffic gm/min	10 Diesel Trucks and 5 Trucks Idling gm/min	10% Increase in Idling Traffic gm/min
Peak AM (1500 Veh/Hr) (20% Idling)	27.4	2.2	7.4
Midday (1200 Veh/Hr) (10% Idling)	17.5	2.2	7.4
Peak PM (1700 Veh/Hr) (35% Idling)	40.2	2.2	7.4

removal of the present paved surface and exposure of the underlying substrate, and the consequent increase in groundwater level as a result of percolation. It is understood that the depth of excavation for the plant itself and the oil tank area will not reach the water table and thus no dewatering of ground water infiltration will be necessary. Prior to installation of the concrete ground slab, the bottom of the excavated pit will be sloped such that water which has collected at the depressed area following large storm events will be pumped to the storm water sewer system. Any pumping of collected water will generally occur after the period of maximum runoff discharge to the Muddy River, thus somewhat alleviating the potential for peak flooding.

The volume of runoff from the site will be less during the early stages of construction due to increased retention of water during minor storm events.

As the later stages of construction are reached, the volume of runoff will approach that of the completed, operational facility. The runoff rates during the operational phase are discussed in Section 5.2.3.

As mentioned in Section 4.2 the site area has not experienced flooding because of its elevation and thus no flooding is expected to occur during construction.

5.1.4 Water Quality

The quality of storm water runoff during the early construction stages will be primarily determined by pumping procedures instituted for water collected in the excavation pit.

Pumping will begin during the runoff phase of the storm and will continue until the water is removed. Since the flow path along the pit bottom is composed of fine-grained materials, runoff waters to the sump pit, where pumping is to occur, will contain high concentrations of suspended solids. The discharge of these waters to the Muddy River is expected to have a short-term deleterious impact on the quality of the receiving water. It is not possible to quantify the magnitude of this impact since no data is available on the quality of the Muddy River during a storm event. However, since the ratio of the volume of the

discharge water to the volume of the receiving water will be very small, it is anticipated that the impact of the suspended solids load on the quality of the river water will be minimal.

As the later stages of construction are reached, the quality of the storm runoff will approach that of the completed facility. The runoff quality during the operational phase is discussed in Section 5.2.4.

All used oil resulting from on-site truck and heavy machinery utilization will be collected in closed containers and properly disposed of off-site.

All sanitary wastes generated during the construction phase will be collected in sanitary toilets, which will be connected to the existing on-site sanitary sewer lines or in chemical toilets. This could result in a sewage load of 10,000 gallons per day during the peak labor phase of 200 on-site workers based on a design wastewater load of 50 gallons/day per worker. The maximum incremental sewage load of 10,000 gallons per day will have an insignificant impact upon the Deer Island Treatment Plant, since this construction generated load is less than 1% of the dry-weather day-to-day flow variation in the Deer Island Treatment Plant.

It is not expected that flammable materials such as gasoline or diesel fuel will be stored on site because of potential hazards. As in most urban construction areas service trucks will visit the site to fill the fuel tanks of the construction equipment.

5.1.5 Geology and Geohydrology

Impacts associated with the construction of the proposed facility are not severe. Excavation for the main plant is not expected to go below elevation 22 feet and excavation for the oil tank area will not go below elevation 15 feet. Thus, all activity will be above the local water table which is at elevation 11 feet. Pumping will be required only to remove any trapped precipitation and surface runoff. It is possible that after removal of the present dwellings on the site, infiltration would be sufficiently augmented to cause some increase in dampness of basements in buildings adjacent to the project. Occurrence of this problem would be anticipated only during and immediately after periods of substantial rainfall. The low permeability of the near surface clays

would, however, tend to diminish lateral transport of percolating waters, indicating that the above consideration should have minimal impact.

Because of the shallowness of the excavation no bedrock removal will be required and no blasting will be necessary. It is currently understood that approximately 25,000 cu. yds of material may be excavated, most of it requiring disposition as spoil. No organic material, objectionable odors, or toxic materials have been noted in the soils to be excavated; however, proper disposition must take into full consideration their clay content and subsequent poor permeability. Wherever disposed, they would impede drainage, both infiltration and subsurface flow, and because of their high clay content would not be suited to the support of vegetation.

Erosion is a problem of some real concern, both on site and in conjunction with the transport and ultimate disposition of the spoils. The clays and fine silts that will be excavated are highly subject to erosion by wind, rainfall runoff, and streams or other waters at the site of disposition. Because of the fineness of the material, suspension in water would be significant. Transport by any of these mechanisms could carry large volumes of this spoil considerable distances. Proper controls can mitigate this impact to reasonable levels, but only if aggressive measures are conscientiously applied. Particular consideration in this regard must be given to the site of disposition as vegetation cannot be depended upon to contain this material from erosive action if left at the surface.

Slopes on the site are generally low and stability will pose no problems except in possible cases of artificial grading. Seismicity of the region should, however, be given consideration in the design of the facility. Though the evidence is controversial, there is some data indicating high seismic risk throughout much of southern New England, including Boston. There are no special building codes in this area which address the seismic issue; design is left to the consideration of the developer and his architect. There are no known geologic structures on or immediately adjacent to the site which would add to the regional seismic risk.

With regard to the geology and groundwater, this project requires no commitment of resources other than the land itself, which holds no particular uniqueness in the general Boston Basin area, and the use of a site for spoil disposition.

5.1.6 Noise

Construction activities at the proposed site will produce a degree of unavoidable noise impact on critical receptors in the immediate project area. This section presents an analysis of the qualitative extent of the noise impact created during the construction period based upon considerations of the nature of the project area, type and use schedule of construction equipment, individual equipment noise characteristics and relative measures of noise impact.

Developers and general contractors are aware of the need and requirements for noise abatement measures. Construction planning to date has incorporated several significant features which will either have the effect of lower noise levels or minimum periods of duration of construction noise levels:

- Demolition will proceed from the center of the site toward the outside, so that the remaining structure walls will provide a barrier effect, reducing noise from both the wrecking operation, as well as from loading and removal operations.
- Removal and supply operations of heavy trucks may be via Brookline Avenue, minimizing the exposure to critical receptors on the quieter side streets.
- Construction activities will be restricted to daytime periods. Normal construction work will begin no earlier than 7 AM and cease by 4:00 PM.

Equipment Noise Levels

It is estimated that the noisiest equipment to be employed for this project will be pile drivers, earthmoving loaders, heavy duty diesel dump trucks used in hauling operations, compressors, and pneumatic tools used in steel erection operations.

The existing and proposed noise generation characteristics of this equipment, as specified by the General Services Administration (GSA) for equipment used on federal projects, is outlined in Table 5.1.6-1. It is believed that the July 1973 specifications given in this table reflect fairly and conservatively the maximum noise generation characteristics of the majority of construction equipment for the present time and for the next several years.

The noise impact of the construction activities is a function of a number of factors, including the duration and intensity of the noise generated during a given phase of construction, as well as the season of the year and whether windows at nearby critical receptors are open or closed. Construction noise will be created at the power plant site and on local streets along the distribution network tunnel route. Because these construction activities will produce different forms of noise impact, they will be treated separately in the following paragraphs.

Tunnel Construction Noise Impact

As discussed in Section 3, the basic routing of the distribution network tunnel is from the power plant site into the area of institutions to the north and east. Since the specific route of the tunnel has not yet been finalized, it is not possible to identify specific critical receptors which might be impacted by tunnel construction noise. However, the close proximity of the institutional facilities to the power plant and the virtual absence of dwelling units in the intervening space suggests that the primary critical receptors will be institutional buildings and pedestrians using sidewalks in the vicinity of the tunnel construction area. The nature of the tunnel construction project is basically a semi-continuous operation of cutting open the street, excavation, form fabrication, concrete pouring, covering with earth and resurfacing. It is estimated that this process will proceed with an average linear rate of 100 to 140 feet per month.*

* Based upon an estimated 1900' total tunnel length and a construction period of 1-1/2 to 2 years. Sections of tunnel of 25 to 50 length will be completed in sequence.

TABLE 5.1.6-1

GSA CONSTRUCTION NOISE SPECIFICATIONS *
Maximum dBA Level at 50 feet

Equipment	Effective 7/1/73	Effective 1/1/75
Earthmoving		
Front Loader	79	75
Backhoes	85	75
Dozers	80	75
Tractors	80	75
Scrapers	88	80
Graders	85	75
Truck	91	75
Paver	89	80
Materials Handling		
Concrete Mixer	85	75
Concrete Pump	82	75
Crane	83	75
Derrick	88	75
Stationary		
Pumps	76	75
Generators	78	75
Compressors	81	75
Impact		
Pile Drivers	101	95
Jack Hammers	88	75
Rock Drills	98	80
Pneumatic Tools	86	80
Other		
Saws	78	75
Vibrator	76	75

* This table represents the construction equipment noise control requirements which apply to work at sites of Federal Government structures under contract with the General Services Administration (Par. 44.8 in Guide Specification PBS 4-01100, October 1973).

The following list is considered representative of the major noise producing pieces of equipment required for tunnel construction:

Equipment	Maximum Noise Level @ 50 feet (dBA)	Quantity of Equipment at Any One Time
Jackhammer	88	1
Backhoe	85	1
Compressor	81	1
Pumps	76	2
Trucks	91	1 or 2

This equipment will not all be operating continuously nor simultaneously, and the noise level at any given time is not only related to the types and quantities of equipment in operation, but their relative placement with respect to piles of earth, projections of shoring timbers and other sound barriers. Nevertheless, this represents a potentially noisy operation with maximum noise levels at 100 feet in the range of 70 dBA when only a single pump is operating to 90 dBA if all equipment is operating simultaneously. This represents a noticeable increase above existing levels.

The impact on passing pedestrians could range from almost complete interference with normal speech communication to varying degrees of annoyance. The impact on the occupants of institutional buildings will depend on their distance from the construction and whether they can close windows which face the construction. If the latter is true, this would produce a minimum building and window net attenuation factor of 25 dBA*,

* Federal Highway Administration PPM 90-2 (April 26, 1972), attachment 3 presents the following noise reductions for exterior wall-window combinations:

Wall Construction	Window Condition	Noise Reduction (dB)
All	Open	10
Light Wood Frame	Closed	20
	Storm Windows	25
Masonry	Single Glazed	25
	Double Glazed	35

resulting in 45 to 65 dBA interior noise levels for masonry buildings approximately 100 feet from the construction. As noted previously, the tunnel construction site will be slowly moving, thus limiting the duration of the maximum levels cited above for any single receptor.

Power Plant Construction Noise Impact

Noise impact during demolition has not been determined because information is not readily available on the noise associated with the impact of a wrecking ball on wood or brick structures, nor is it available on the noise resulting from the collapse of a structure. However, the short duration, two months, and previously mentioned fact that demolition will proceed outward from the center of the site, with the building walls facing the streets serving as sound barriers during most of this two month period, will tend to reduce the total impact of the demolition phase.

The excavation phase, two to three months long, represents a high point in noise generation because it uses the greatest daily volume of trucks (60 trucks per day) and also requires other high noise pieces of equipment, including backhoes and front end loaders. To determine the noise levels associated with this period, the following model was considered:

Equipment	Maximum Noise Level @ 50 feet	Quantity of Equipment
Backhoe	85	1
Front Loader	79	1
Pumps	76	4
Trucks	91	2*
Drilling rig	88	1**
ALL OF ABOVE OPERATING SIMULTANEOUSLY	96	

* 60 trucks per 8-hour day represents an average of 1 truck per 8-minute interval. For this model an average of two trucks, one loading and one waiting was postulated.

** Data on earth drilling rigs is not readily available, here the assumption is that its noise level would be equivalent to a derrick or jack hammer.

The maximum noise level exists for the case of all equipment operating concurrently. Summing the noise levels in this instance results in a maximum level of approximately 90 dBA at a distance of 100 feet and 84 dBA at 200 feet from the assumed center of equipment operation. In reality, the equipment will not all be in operation at one time, or near one point and some pieces may be below street grade level and thus will be shielded from critical receptors. Critical receptors are at distances of approximately 100 to 200 feet from the construction site, receiving maximum exterior noise levels corresponding to 90 to 84 dBA, respectively.* Interior levels will be lower by 10 dBA if the windows are open and lower by 20 dBA or more if the windows are closed. Thus, if the excavation phase coincides with cold weather, when windows are normally closed, the maximum interior noise levels due to construction noise would be approximately 70 to 64 dBA.

The preceding discussion considered continuous or semi-continuous construction activities and did not include the impact of pile driving. As shown in Table 5.1.6-1, pile drivers can produce noise levels around 100 dBA at a distance of 50 feet. However, the intermittent generation of noise makes this a more prominent noise source instead of allowing it to blend in with the other on-going construction activities. It is expected that properties adjacent to the site will experience enough noise and annoyance to disrupt or disturb most activities during the period of pile driving.

Construction noise impact can occur only during the normal working hours, 7:00 AM to 4:00 PM, and is primarily related to diesel truck activity. The maximum interior noise levels during excavation will range between 80-74 dBA (windows open) to 70-64 dBA (windows closed). These levels will represent a disturbing intrusion to those residents closest to the construction site. (See Table 4.5-1 for a comparison of noise levels associated with various human activities.) Truck activity will continue throughout the construction period and when they drive down Francis Street they can cause levels high enough to interrupt normal communication inside the residences.

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* These noise levels are for receptors having an unobstructed line of sight to the construction machinery. Receptors that are completely blocked from the machinery by rows of buildings may realize a noise reduction of 10 to 15 dBA, due to barrier attenuation.

5.1.7 Ecology

It has been considered that during the construction phase all of the existing vegetation on the site will be removed. Most vegetation will be removed directly and any remaining vegetation will probably be destroyed by the construction activities. This habitat loss will displace the wildlife from the site to similar habitat in the area. The impact of this displacement will be insignificant because of the limited value of the site as wildlife habitat and due to the small amount of vegetation on the site. Special care will be used to protect the tree on the corner of the Frederika property. After construction, any damage to the vegetation near the Frederika Home will be replanted.

Rats and mice (Family Muridae) inhabiting the existing structures will be exterminated prior to structure demolition to prevent their moving to inhabited areas. Extermination will be accomplished using pesticides bearing Environmental Protection Agency (EPA) registration numbers. Such pesticides are considered safe by the EPA if label instructions are followed during application.

5.1.8 Social and Economic Characteristics

There is concern in the community regarding the possible long-term involvement with the construction of the proposed facility and the fear that parking, already viewed as a monumental problem, will be severely aggravated by the increased traffic it would necessitate. Their perceptions are based on the construction impacts they have experienced from past and current construction activities in the area and they are realistic concerns.

Construction workers in the vicinity will require certain goods and services within the community. This should increase business in various Brigham Circle establishments and along Brookline Avenue. The construction period will last approximately two and a half years and will provide employment for about 200 people, mainly those already associated with construction work.

Social impacts to adjacent properties during the construction phase will include a number of the annoyances usually associated with major construction projects. Dust, as a result of the excavation, may create

the need for additional housekeeping in the project vicinity, even though the contractor will take appropriate actions in an attempt to minimize this problem.

Traffic congestion problems will likely hinder the incoming and outgoing construction vehicles. Residents and employees will also be affected by the congestion due to this project and concurrent loss of parking places in the area.

The noise of the trucks associated with construction will be considerable (86 dBA at 50 feet). The construction equipment will be in operation from 7 or 8 AM to 4:00 PM. This will affect rest periods, television viewing and other daytime communication activities. No nighttime construction activities are planned.

Any perception of danger concerning children playing within the construction site will be somewhat alleviated by a fence placed around the periphery of the site. Excavation will not begin until this is in place.

There are no available data to enable any determination of the impact construction would have on the neighborhood residents' tendency to move out.

The removal of rental units from the site may have an impact on housing availability in the neighborhood on a short term basis until the housing projects planned for the area are complete. Since rent control laws regulate rent increases it is not likely that rents would increase even if a noticeable housing shortage occurred.

Except for planning for this project, the residential units along Francis Street would probably have remained as rental units. It is possible that plans could be developed for converting the buildings to some other institutional use. The eight multi-family dwellings and six single family dwellings could be renovated for housing. However, since some of these buildings are owned by institutions, it is not possible to accurately speculate on a potential future use. The institutional buildings would probably remain as administrative offices.

The loss of potential housing has not been considered significant because of the housing that will be provided by the Mission Park Project and other housing developments planned beyond the project area.

5.1.9 Land Use

Impact Upon Adjacent Land Uses

Construction activities will undoubtedly be a source of irritation for those living and working in close proximity to the proposed site. In general, the severity of impact upon adjacent land uses will rapidly diminish with distance from the source. As a result, negative impacts will tend to be relatively localized.

As was noted in the land use inventory section of this report (4.8), there are a variety of activities taking place in the areas adjacent to the proposed project site which have widely differing levels of susceptibility to the negative externalities to be created during the construction period. The most susceptible land uses in terms of the noise, dust, and dirt to be generated during the construction phase will be the residential activities located in the Frederika Home and along the south side of Francis Street. The Sidney Farber Cancer Center Redstone Laboratory; the Children's Hospital and adjacent parking lot; and the commercial activities along Brookline Avenue should be minimally affected by the proposed construction schedule.

Solid Waste Disposal

The solid waste generated from site clearing activities, consisting primarily of demolition debris, will be disposed of off-site at a sanitary landfill. Although this project is located within the City of Boston, this debris will not go to the Boston landfill because this facility is already operating at capacity. Two possible disposal locations are the Lynn Marsh Dump, operated by DeMatteo Construction Company, in Saugus, and a landfill operation of SCA services in Amesbury.

This disposal of the excavated material has more options, since it could be utilized as clean fill in another project at the option of the disposal subcontractor. These excavation spoils, however, might have a sufficiently high clay content to preclude its use for surface fill.

Visual Environment

The visual environment will be altered with the various construction activities which are common to large scale projects. This will

replace the relatively static setting with more dynamic activities. Views of construction are generally considered unattractive because of the apparent disorganization and incompleteness of the structure. Such views will persist until the shell of the building has been completed.

Persons most directly affected will be those located in the Frederika Home and along Francis Street. Other areas further removed from the site will see the erection of the taller portions of the building and the stack. Views from these areas and from tall buildings will be less affected since they will encompass construction of other projects.

Visual impact of the distribution tunnel construction will be localized within the institutional area.

Historic, Architectural, Archeological and Scenic Significance

The only effect of the project on historic features will be the changing view from Olmsted Park. The views from the park would not include much of the project since it will be a low structure. The upper portion of the cooling towers and the stack will be visible. All other construction activities will be localized about the site. It is, therefore, not expected that the plant would detract from the scenic, historic or recreational value of the park.

Because there are no particularly unusual architectural features or archeological attractions known to exist on the site the project construction will have no significant impact on these land uses. The removal of the Faxon building will be a loss of an interesting although not unique architectural feature.

Community Facilities and Services

Police and Fire Protection

The project could interfere with area police protection since it will place some demand on these services for traffic control. This is addressed in a letter from the Boston Police in Section 8. If city police are needed, the City will be reimbursed by the project. On-site security measures will be provided during non-working hours by the owner to prevent vandalism and the distribution tunnel will be blocked to prevent access. Traffic patrolmen may be required to direct traffic

when the distribution tunnel reaches a roadway and when a large piece of equipment is to be transported to the site, and possibly during more routine truck movements. Safety programs will reduce the potential of fires and not place any demand on city fire protection services.

The closing of Peabody Street will prevent police and fire fighting equipment from using this route into the medical area; however, sufficient access is possible from other streets. Construction of the distribution system will be conducted so that no roadways will be completely blocked to vehicles.

Medical Facilities

Construction on the site will affect the Children's Hospital health care programs and the dental office of Dr. Thompson, which are located on the site. Both the doctor's office and the services of the Children's Hospital will be relocated within the medical area so their functions will not be removed from the project area.

Construction activities will not prevent access to any of the other facilities surrounding the site even though Peabody Street will be closed and other streets will experience some disruption.

Educational Facilities, Open Space, Recreation and Neighborhood Services

The construction activities will be concentrated on the site and should therefore have no effect on the Farragut School or the play area at the corner of Fenwood Road and Vining Street. Truck movements will be away from these areas.

It is anticipated that no neighborhood services in the project area will experience any impacts.

Area Utilities

All connections and disconnections of the gas, water and sewer can be done without discontinuing services. Thus people in the area will not be inconvenienced.

Transportation

The construction related transportation impacts caused by the project will be due to: 1) the closing of Peabody Street, 2) the construction related trucks, and 3) the construction worker automobiles.

This closing of Peabody Street, which is also included in the operational phase, is discussed in more detail in Section 5.2.9.

Construction at the site will require trucks for site preparation and delivery of construction materials. Figure 5.1.9-1 shows the daily average number of trucks expected throughout the construction period.

The major truck related impacts during the construction period will take place during the excavation of the site. During this phase of the operations, an estimated 25,000 cubic yards of excavated material will be removed in 12 cubic yard trucks. This removal of this excavated material will require approximately 60 trucks per day which is indicated in Figure 5.1.9-1 along with the other construction activities. As indicated in this figure, the estimated concrete deliveries will average 3 trucks per day over an eight month period. However, these deliveries will be intermittent, with as many as ten to 20 trucks per day (usually all in the morning). These trucks will utilize Brookline Avenue, Francis, Binney, and Peabody Streets and will contribute to the congestion that already exists. Principal truck access to the site will be along Peabody Street, but Binney Street will also be at least partially blocked by trucks entering and leaving the site. The impact of these trucks will be to occasionally aggravate the existing congestion.

In order to avoid aggravating the existing deficiency of parking spaces, the owner of the project will provide and pay for the necessary off-street parking facilities and bus transportation to the construction site for construction worker use. MASCO is now in the process of setting up temporary alternate parking facilities for the medical area institutions due to the closing of the Vining Street lot for the construction of the Mission Park housing. It is expected that those arrangements can be made available for construction worker parking.

The distribution tunnel described in Section 3.5 will cross Longwood Avenue. The construction of the tunnel across the roadway should take

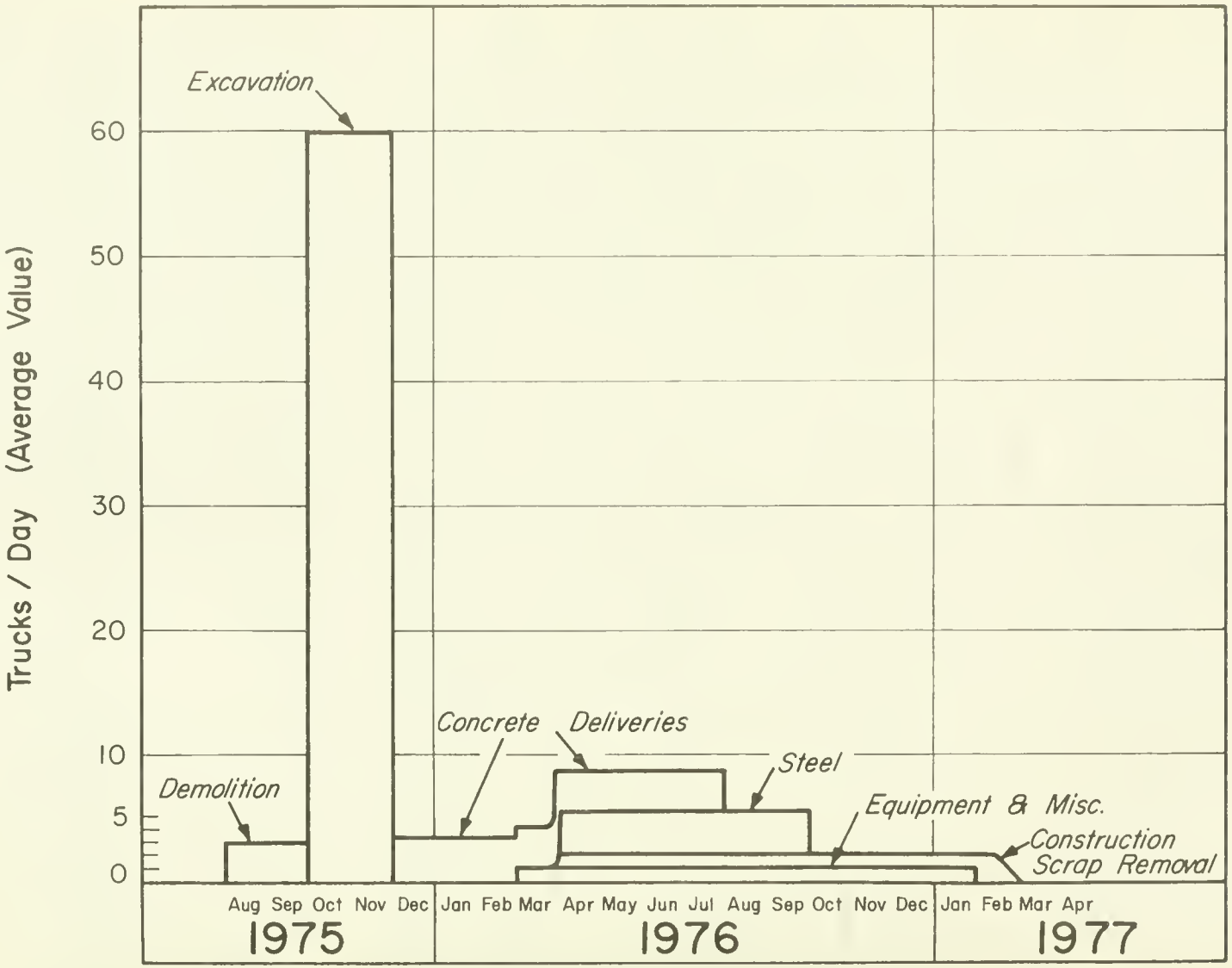

Figure 5.1.9-1 Truck Movements During the Construction Period

less than one month. This will cause traffic build-ups since traffic will have to go around the construction area as it proceeds in stages across the street. This work will be similar to that used by utility companies. If traffic congestion is severe, this work mary be done during off hours.

Another area of investigation has been the shipment of the heavier pieces of generating equipment to the site. The Riley Stoker Corporation has been examining the shipment of the boilers to the job site. The size and shipping weight of the boilers are as follows:

Height - 16'-8"
Width - 12'-8"
Length - 42'-10"

Three Boilers - 229,000 lbs. each
Two boilers - 195,850 lbs. each

Specific information on the engines is not yet available but it appears likely that they will follow the same general delivery methods as the boilers once they reach Boston Harbor. The original arrangements for transportation of the boilers were as follows:

> They will be taken by rail from the Erie Plant to the dock in Erie, Pennsylvania and loaded onto the barge. They will then be transported by barge to Boston Harbor. At that point the preliminary indication is they will be off loaded at Castle Island. The trucker, which at this point has not been definitely determined, will then (by using a special trailer) transport these units over Boston streets to the site. The intent is that each unit will be loaded onto the trailer at the dock and that actual movement of the boiler will take place in the early morning hours, approximately between 3 and 5 AM. The trucker is responsible for all police protection, informing of required City departments, procuring permits, etc. Riley Stoker has checked with several trucking firms in the Boston area and has been informed by all of them that this type of move goes on virtually nightly in the Boston area; whether it is moving heavy construction equipment or heavy industrial items.

On November 12, 1974, a new law (Chapter 851 of the Acts of 1974) amended Section 30 of Chapter 85 of the General Laws to require the

owner or lessee of any truck/trailer to obtain a permit from the Commissioner of Public Works before loads can be carried on a public way where the combined weight would exceed applicable weight limits established by that section or by Chapter 90 of the General Laws. Although the Commissioner is not normally authorized to issue permits for any vehicle which with its load will weigh more than 99,000 pounds, there is a proviso to the section under which

> "...the Commissioner of Public Works may issue one-way or round trip permits for the carrying of certain irreducible loads, which may exceed the said gross vehicle weight rating, but only under such conditions and limitations as the Commissioner of Public works may prescribe."

The trucker selected to move generating equipment to the site will be obligated to obtain the required permits from the Commissioner of Public Works. If such permits are not granted, alternative shipping arrangements would need to be made.

5.1.10 Combined Construction Effects

As presented in Section 4.8 there are several construction projects in the medical area which will be under construction concurrently with the total energy plant. These include the following:

Sidney Farber Cancer Center - Completion 1976

Joslin Howard F. Root Wing - Completion 1976

New England Deaconess Hospital Radiation Facility - Completion 1976

Rehabilitated Housing - Completion 1975

Children's Hospital Entrance Pavilion - Completion 1975

Beth Israel Feldberg Addition - Completion 1976

Boston State Library - Completion 1975

New England Deaconess School of Nursing - Completion 1976

Affiliated Hospitals Center - Starting fall of 1975 extending for 5 years

MASCO Service Center - Schedule not established

Mission Park Housing - Starting 1975 ending 1977

Seeley G. Mudd Biochemical Laboratory - Starting in 1975

Boston State General Building - Schedule not established

Boston State Parking Garage - Schedule not established

Simmons College Addition - Schedule not established

New England Deaconess Garage Extension - Start in summer of 1975 and end in 1976.

These projects together with the proposed project scheduled for fall of 1975 through 1977 have the potential for significant cumulative impacts. All of the projects may increase noise levels in the area, production of fugitive dust, emissions from trucks, will affect parking supply and demand and traffic circulation and may result in adverse visual impacts. Since all other projects will operate independently and detailed schedules have not been established, it is difficult to quantify the extent of expected impacts.

Noise levels throughout the construction areas will be elevated above background levels. While sound pressure levels will probably not be additive because of distance between projects, people passing through the area will be exposed to the higher noise levels of construction activities over a larger area.

Fugitive dust caused by the movement of earth during excavation will increase particulate levels in the area. Since particulate levels in Boston approach the air quality standards for particulates, it is expected that if all excavation activities were to occur concurrently the standards may be exceeded.

Carbon monoxide emissions from trucks working on the sites and traveling to and from the sites may increase carbon monoxide levels in the area. As shown in Section 5.1.2 the construction of the proposed total energy plant would account for a 6% increase in CO emissions and when all projects are considered the overall CO emissions could be significant. If truck traffic causes traffic buildup on major arteries, the resulting increase in CO emissions would be more significant. These increases in CO emissions will be offset to some degree by the necessary removal of parking lots in the area which will reduce automotive emissions.

Parking demand and traffic circulation will be affected by construction by the closing of parking areas, the parking demand for construction workers and the trucks traveling to and from the site. At the time of construction of the total energy plant spaces for 1,680 cars will be removed for construction of the Mission Park Project. Remote

lots will be established for employees and for construction workers on the Affiliated Hospitals Center and the total energy plant and the construction site for Mission Park can accomodate workers on that project.

During construction on the various projects it is likely that local curb parking will be eliminated by localized disruptions, street closings and construction worker parking. This lack of curb parking has been experienced in the area for many years. It is likely that the lack of parking close to the medical area will result in employees, patients and visitors using remote parking, public transportation, taxis or being dropped off at the door.

The use of remote parking areas will reduce the traffic through the medical area produced by cars which use the lots which will be closed. This will be a net benefit during morning and evening peak traffic periods.

Traffic circulation or congestion problems created by trucks traveling to and from the site is difficult to determine since each project may use different truck routes. For example, the Mission Park Project will use Huntington Avenue, while the energy plant will use Brookline Avenue. If congestion occurs turning off of or onto the major arteries, traffic patrolmen will be used to direct traffic. The traffic situation will become more defineable as schedules for all the proposed projects are established. Each project will have to ensure that it does not interfere with access to the medical area.

The aesthetics of major projects being constructed will not be pleasing as construction results in industrial-like appearances. Until building shells are complete, the exposed structural numbers and construction equipment will be incongruous to established residential, commercial and institutional uses. This is an unavoidable effect of construction. It will, however, be localized to the medical area.

It should be noted that these impacts are not produced by anyone project but by all the proposed projects together. Termination of one would not have as significant effect on overall impacts. Scheduling of construction activities, such as demolition and excavation - which use the most trucks - so they are not concurrent, would alleviate some of the problems of noise, fugitive dust and traffic circulation problems.

Effects of construction from the proposed projects should not be more extensive than those produced from past construction efforts that have already occurred in this area. The establishment of the Medical Area Service Corporation should help to minimize impacts by overall coordination and interaction with activities in the area.

5.2 Operation

5.2.1 General Description of Operational Activities

The total energy plant will produce steam for space heating, various processes such as sterilizing equipment and making hot water and for air conditioning in absorption chillers and in steam turbine driven centrifugal chillers. Peak and annual steam requirements for the institutions and plant operation will be as follows:

	Peak Consumption lb/hr	Annual Consumption lb/yr
space heating		828,400,000
process	677,000	451,000,000
air conditioning		390,200,000

Total annual demand including use in the central plant and distribution losses will be about 1,669,600,000 lb/year. Monthly use of steam has been determined by apportioning the annual consumption to each month based on ambient temperature for heating and cooling and constant use of process steam. This is shown in Table 5.2.1-1. A further breakdown of peak hourly steam demand expected each month is shown in Table 5.2.1-2.

Annual electricity consumption by the institutions will be approximately 131,300,000 kwhr. The energy plant's consumption for operating heating and cooling equipment will be 7,737,000 kwhr and 33,946,000 kwhr, respectively. Thus total production of electricity will be approximately 172,983,000 kwhr/yr. The peak and total monthly electricity demands of the institutions are presented in Table 5.2.1-3.

TABLE 5.2.1-1

MONTHLY STEAM CONSUMPTION FOR SPACE HEATING, PROCESS AND AIR CONDITIONING[1]

Steam Consumption (10^3 lbs)	January	February	March	April	May	June	July	August	September	October	November	December
Space, Process, Absorption Air Cond.	193,000	182,000	154,000	115,000	77,000	62,000	65,000	60,000	66,000	89,000	131,000	178,000
Steam Centrifugal Chillers*				6,000	15,000	50,000	87,000	73,000	44,000	12,000	6,000	
Steam Dist. Loss 10% x line 1	19,000	18,000	15,000	12,000	8,000	6,000	7,000	6,000	7,000	9,000	13,000	18,000
Subtotal	212,000	200,000	169,000	133,000	100,000	118,000	159,000	139,000	117,000	110,000	150,000	196,000
10% Central Plant Use	21,000	20,000	17,000	13,000	10,000	12,000	16,000	14,000	12,000	11,000	15,000	20,000
Plant Steam Output	233,000	220,000	186,000	146,000	110,000	130,000	175,000	153,000	129,000	121,000	165,000	216,000

TABLE 5.2.1-2

PEAK HOURLY STEAM DEMAND EXPECTED EACH MONTH[1]

Summary of Peak Demands (lbs/hr)	January	February	March	April	May	June	July	August	September	October	November	December
Space and Process	559,000	559,000	446,000	371,000	292,000	218,000	179,000	179,000	218,000	331,000	407,000	521,000
Absorption Air Cond.				16,000	35,000	54,000	62,000	54,000	43,000	25,000	6,000	
Centrifugal Chillers*				49,000	107,000	166,000	195,000	166,000	137,000	78,000	20,000	
Total	559,000	559,000	446,000	436,000	434,000	438,000	436,000	399,000	398,000	434,000	433,000	521,000
Dist. & Plant Loss	118,000	118,000	94,000	92,000	92,000	92,000	92,000	84,000	84,000	92,000	91,000	110,000
Boiler Peak Output	677,000	677,000	40,000	528,000	526,000	530,000	528,000	483,000	482,000	526,000	524,000	631,000

*Maximum Demand assumes that three steam turbine driven centrifugal chillers are in operation (15,000 tons at 13 lbs/ton = 195,000 lbs/hr).

The steam consumption for the centrifugal chillers is conservatively high since it is based on a design of using three steam turbines to drive the chillers. In actual operation only one steam turbine driven chiller will be used along with two motor driven chillers. The project will not even contain three steam turbine driven chillers.

TABLE 5.2.1-3

ESTIMATED MONTHLY ELECTRIC USEAGE BY MEMBER INSTITUTIONS (1)

	January	February	March	April	May	June	July	August	September	October	November	December
Peak hourly demand, kw (diversified)	24,680	20,280	21,313	21,290	22,946	24,479	26,000	24,686	24,376	23,795	22,500	22,500
Monthly consumption kw hr x 10^3	10,095	11,916	10,491	9,537	10,893	11,317	12,122	12,020	11,644	10,690	9,875	9,400

Peak demand for the energy plant operation will be approximately 6,000 kw during the summer months and 2,000 kw during the winter.

Chilled water for air conditioning will be produced at a peak rate of 15,000 tons/hr. Based on a design condition that annual consumption equals 1,500 hours of peak demand, the annual chilled water consumption is 22,500,000 tons. The steam and electrical consumption necessary to produce this quantity of chilled water has already been included in determining the energy plant's production of steam and electricity.

Since the steam, electricity and chilled water generating equipment will be interrelated, their operation will be balanced to provide for the needs of the institutions as efficiently as possible. For example, steam produced in the boilers for heating will first drive the back pressure, steam-turbine driven generator to generate electricity. For six winter months, this turbine generator will produce 10,300 Kw and 6,640 Kw the remaining six months. The diesel driven generators will make up any deficiency in electrical needs and produce steam for the institutions at the same time, up to a maximum of 80,000 lbs/hr. Diesel and incinerator exhausts will add heat to the boilers which will reduce their fuel consumption rate.

It is expected that annual fuel oil consumption will be about 21,453,400 gallons and that a peak monthly use of 2,300,000 gallons will occur during the winter. Oil deliveries by 6,000 gallon capacity trucks would average 13 trucks per day during this period. Since the storage capacity is for 1,100,000 gallons, truck deliveries can be scheduled to reduce traffic impacts and disturbance to area residents.

Water demand for the energy plant will be at a maximum during the summer cooling season. At this time, heat must be removed from the condensers of the water chillers and steam turbine drivers by the circulating water passing through the condensers and into the cooling tower where the heat will be released to the atmosphere. Each water chilling unit requires 14,280 gpm of circulating water for cooling; and at maximum cooling output of 15,000 tons, circulating water flow is 42,840 gpm. Maximum evaporative losses will not exceed 650 gpm and maximum blowdown to maintain acceptable levels of chemicals in the cooling tower will be about 150 gpm. Water intake to the plant must equal these losses plus

drift loss of less than 0.1% of the circulating water flow. (Drift is water in droplet form that is carried out of the cooling tower by air passing through it.) The total maximum water use rate for the cooling tower will be about 800 gpm. If this occurred for 1,500 hours of peak chilled water production, the annual water use would be 72,000 gal/yr.

Other major needs for water will be for condensate makeup which replaces steam that is not returned to the boilers and losses in the distribution of steam to the institutions. Condensate losses and distribution losses will be approximately 17,000,000 gal/yr. Water will also be required for the boilers to make up for boiler blowdown of 15 gpm which maintains chemical levels in the boilers at acceptable levels. Annual consumption will be about 7,884,000 gal/yr. Total annual water consumption will thus be about 25,000,000 gal/yr.

Other water uses include service water for equipment washing and fire protection and sanitary purposes. These flows are insignificant when compared to equipment requirements since they are not continuous flows. It is expected that equipment washing will be about once or twice in the lifetime of the equipment and the fire protection will not be required. Sanitary sewage will be about 500 gallons per day. All water will come from the City of Boston.

General rubbish will be collected via underground pneumatic tubes from the institutions, eliminating the frequent trips into and out of the area by disposal contractors. Two general refuse incinerators will be provided, each having the capacity to handle the entire hospitals' load during a 17-hour period. This sizing will allow for future expansion while still keeping the 100% standby feature. The waste will be delivered pneumatically to the operating unit which will also be fired with oil in order to maintain the correct furnace temperature. The refuse will be fired in batches and ashes dropping through the grate into the ash hopper will be automatically transferred to the dinosaur dumpster. Since the exit temperature will not entirely eliminate odors, flue gases plus air in the pneumatic system will be used as combustion air in the main boilers, where odors and some particles will be incinerated at temperatures over 2000° and heat generated by burning the refuse will be recovered as steam. Pathological wastes will not be handled in this plant.

An 80% weight reduction in waste would produce approximately 2.8 tons of incinerator residue per day. Ash collected in the cyclones following the steam boilers will go to the same ash dumpster as the incinerator ashes. It is expected that these cyclones following the boilers will collect only a small quantity of ash due to the low ash content of the fuel.

The following sections discuss the impacts of these operating characteristics.

References for 5.2.1 General Description of Operational Activities

1) Energy Make or Buy, prepared for Harvard University by Paul L. Geringer and Associates, 1973

5.2.2 Air Quality

This section describes the air contaminant emissions expected from the project and the predicted impact on ambient air quality.

Emission Regulations

Regulations have been established on state and federal levels to control the emission of air contaminants from various types of sources. The Massachusetts Air Pollution Control Regulations that pertain to this project are presented in Table 5.2.2-1. It should be noted that application of the state particulate and oxides of nitrogen standards to the proposed facility are dependent on heat input. If each steam boiler were considered by the state to be a separate unit, then the less stringent emission limits would apply since each unit has a heat input of less than 250×10^6 Btu/hr. However, the state considers the boilers to be combined, thus applying the more stringent emission limits since the total heat input to the boilers will be in excess of 250×10^6 Btu/hr.

TABLE 5.2.2-1

MASSACHUSETTS AIR POLLUTION CONTROL REGULATIONS
(Adopted June 1, 1972; Amended September 1, 1972 and June 7, 1973)

Steam Boilers

particulates

heat input	
3 to 250 x 10^6 Btu/hr.	0.10 lb/10^6 Btu
> 250 x 10^6 Btu/hr.	0.05 lb/10^6 Btu

oxides of nitrogen

< 250 x 10^6 Btu/hr.	no regulation
> 250 x 10^6 Btu/hr.	0.3 lb/10^6 Btu

sulfur dioxide*

sulfur content of fuel must not exceed 0.28 lb/10^6 Btu

visible emissions**

smoke shade less than No. 1 of the Ringelmann scale except for a total of six months in an hour when smoke shade can increase but remain less than No. 2 of the Ringelmann scale.

odors

shall not be allowed to contribute to air pollution

* The sulfur content of 0.28 lb/10^6 Btu is equivalent to a content of about 0.5% by weight.

** Ringelmann scale is a measure of light attenuation. No. 1 of the scale indicates that 10% of the light does not pass through the smoke. No. 2 indicates that 20% of the light does not pass through the smoke.

Table 5.2.2-1 (Continued)

Diesel Driven Generators

particulates

no regulation

nitrogen oxides

no regulation

sulfur dioxide*

sulfur content of fuel must not exceed 0.28 lb/10^6 Btu

visible emissions

excessive emissions of visible air contaminants other than water are prohibited

odors

shall not be allowed to contribute to air pollution

Incinerators

particulates

commercial, industrial residential

0.10 grams/SCF @ 12% CO_2

no particles may be emitted that have a dimension greater than 100 microns

visible emissions

smoke shade always less than No. 1 of the Ringelmann scale

odors

shall not be allowed to contribute to air pollution

Fuel Storage

no emission regulations apply to storage of No. 6 oil because its true vapor pressure is less than 1.5 psi.

*The sulfur content of 0.28 lb/10^6 Btu is equivalent to a content of about 0.5% by weight.

At this time there are no federal emission standards which are applicable to this project. This is because the equipment to be installed is either smaller than limits of applicability set by the federal Standards for Performance for the type of New Stationary Sources[1] or no performance standards have been promulgated for the equipment being installed. There are no federal emission standards for stationary diesel generators, the regulations for fossil fuel steam generators apply only to individual units with heat input of more than 250 x 10^6 Btu/hr and regulations for incinerators are for units with charging rates of more than 50 tons/day.

Emissions from the Combustion Equipment

Emissions from the Diesels

Each of the Mirrless diesels can burn approximately 3500 lbs of No. 6 oil per hour and produce about 124,800 lbs of flue gas per hour at full load conditions. At these conditions the excess air will be about 125% and the firing rate will be about 65 x 10^6 Btu/hr.

Sulfur dioxide emissions from the diesels are dependent on the sulfur content of the fuel and the amount of fuel burned. During full load conditions a diesel could emit 35 lbs of SO_2/hr when oil with the maximum allowable sulfur content of 0.5%, 0.28 lb/10^6 Btu, is burned.

$$\frac{3{,}500 \text{ lbs oil}}{\text{hr}} \times \frac{0.005 \text{ lb S}}{\text{lb oil}} \times \frac{64 \text{ lbs } SO_2}{32 \text{ lbs S}} = \frac{35 \text{ lbs } SO_2}{\text{hr}}$$

Particulate formation is due to noncombustible ash contained in the fuel and incomplete combustion which allows production of some unburned carbon. The ash content of low sulfur No. 6 oil burned in the Boston area during the past year has been consistently below 0.05%.[2] Based on this ash content, the emission rate of particulates formed from the ash would be about 1.75 lbs/hr per diesel.

$$\frac{3500 \text{ lbs oil}}{\text{hr}} \times \frac{0.0005 \text{ lbs ash}}{\text{lb oil}} = \frac{1.75 \text{ lbs particulate}}{\text{hr}}$$

This is an emission rate of about 0.027 lb/10^6 Btu heat input which is less than the emission standard of 0.05 lb/10^6 Btu.

Estimation of formation of unburned carbon particulates for the diesels has not been made since the turbocharged air and direct fuel injection should provide virtually complete combustion which would produce a negligible amount of carbon. Furthermore, any unburned carbon should be incinerated in the steam boilers.

Nitrogen oxide formation is difficult to determine since it is dependent on many engine and operational variables such as air fuel ratio, air manifold temperature, ignition timing, exhaust back pressure, torque, speed and valve overlap. The diesel manufacturer has indicated that his engines will have an NO_x concentration in the exhaust of not greater than 950 ppm. With the exhaust rate of 124,800 lbs/hr the NO_x emission per diesel, calculated as NO_2 would be approximately 188 lbs/hr.

$$\frac{950 \text{ ft}^3 \text{ NO}_2}{10^6 \text{ ft}^3 \text{ flue gas}} \times \frac{46 \text{ lb NO}_2}{359 \text{ ft}^3} \times \frac{359 \text{ ft}^3}{29 \text{ lbs flue gas}} \times \frac{124{,}800 \text{ lbs flue gas}}{\text{hr}} =$$

$$\frac{188 \text{ lbs NO}_2}{\text{hr}}$$

This is an emission rate of 2.9 lbs/10^6 Btu of heat input. A study conducted by EPA of stationary gas turbines and diesels has shown that diesels similar in method of fuel and air charging can be expected to have an NO_x emission rate of 3.0 lbs/10^6 Btu of heat input.[3] There are no NO_x emission regulations that are applicable to diesel engines. No further alteration of this quantity of NO_x in the diesels' exhaust will occur as it passes through the steam boilers since the temperatures will be below 2600°F, the range for enhanced conversion of NO_2.

Carbon monoxide is another contaminant of interest from operation of diesels. Based on EPA studies[3] the expected emission rate from the type of diesel to be installed in the total energy plant is about 1.2 lb CO/10^6 Btu of heat input. Each diesel at full load could emit about 78 lbs of CO per hour. The emission of CO from the diesels has not been considered in greater detail since the diesel exhaust will normally be used as partial combustion air to the steam boilers where the CO will be oxidized to CO_2.

Based on expected operation and the allowable particulate and SO_2 emission rates, the peak and annual diesel emissions will be as follows:

SO_2	129 lbs/hr	537,730 lbs/yr
NO_x calculated as NO_2	695 lbs/hr	2,884,900 lbs/yr
Particulates	12.0 lbs/hr	49,740 lbs/yr

This is based on a maximum electrical generation by the diesels of about 26,000 kw and an annual fuel usage in the diesels of 6,894,000 gallons.

Emissions from the Steam Boilers

Each of the three high pressure boilers will burn approximately 12,800 lbs of oil/hr and have a heat input of about 240×10^6 Btu/hr. Each of the two saturated steam boilers will burn approximately 10,900 lbs of oil/hr and have a heat input of about 202×10^6 Btu/hr.

Sulfur dioxide emissions from the boilers are dependent on the sulfur content of the fuel and the amount of fuel burned. During full load conditions a high pressure steam boiler would emit 128 lbs of SO_2/hr when oil with the maximum allowable sulfur content of 0.5%, 0.28 lb/10^6 Btu, is burned.

$$\frac{12{,}800 \text{ lbs oil}}{\text{hr}} \times \frac{0.005 \text{ lbs S}}{\text{lbs oil}} \times \frac{64 \text{ lbs } SO_2}{32 \text{ lbs S}} = \frac{128 \text{ lbs } SO_2}{\text{hr}}$$

Particulate formation is due to noncombustible ash contained in the oil and unburned carbon. Based on an ash content of low sulfur No. 6 oil of 0.05% the particulates produced from a high pressure boiler would be approximately 6.4 lbs/hr.

$$\frac{12{,}800 \text{ lbs oil}}{\text{hr}} \times \frac{0.0005 \text{ lbs ash}}{\text{lb oil}} = \frac{6.4 \text{ lbs particulate}}{\text{hr}}$$

For oil with a heat content of 18,500 Btu/lb the particulates will be produced at a rate of about 0.027 lbs/10^6 Btu which is below the Massachusetts emission standard of 0.05 lb/10^6 Btu.

Formation of unburned carbon will add to the particulate loading but the amount formed is difficult to determine for this installation. Large boilers carefully controlled can virtually eliminate unburned carbon while the particulates formed in a combustion process with wide variation of operation may be 90% unburned carbon. Since the proposed

design uses exhaust from diesels and an incinerator, variations in electrical, steam and chilled water demand and quantities of incinerated material, the amount of ambient air will be changing frequently. An oxygen analyzer will measure the oxygen in the incoming exhaust gases and regulate the required amount of ambient air to maintain an excess air rate of about 15 to 20%. These variables may result in enough unburned carbon so that the emission standard will be exceeded. Therefore, a multitube cyclone has been incorporated into the design to maintain emissions at or below the emission standard.

The degree of collection efficiency required from the cyclone is dependent on the quantity of particulates produced in the boilers. For example, if unburned carbon is produced in the same quantity as the ash, the total particulates formed per hour in one high pressure boiler would be about 12.8 lbs/hr. The allowable emission would be 12 lbs/hr. Therefore, 0.8 lbs of particulates would have to be removed which results in a required efficiency of only 7%.

A cyclone manufacturer has guaranteed that collection efficiency will be about 90% based on a particle size distribution supplied by Paul Geiringer and Associates. While variations in the actual particle size distribution from that specified could alter the stated efficiency of the cyclone, it is expected that the cyclone does not need to be very efficient to comply with Massachusetts emission standards.

The cyclone should be effective in preventing the emission of any large particles that may be formed during normal and sootblowing operations. Sootblowing is an operation using jets of air or steam to remove any particulates that collect on the tubes carrying water and steam within the boilers. The sootblowing cycle has not been established since the actual ash accumulation rate on the tubes will be determined during actual operation. It will be conducted frequently enough to prevent a large buildup of ash which would lower efficiency and this prevents sudden release of a higher quantity of particulates. It is also expected that there will not be much of a tendency to accumulate ash deposits in the boiler because of the low ash content of fuel.

In the calculation of overall particulate emissions from the boilers the allowable emission rate of 0.05 $lb/10^6$ Btu has been used since this is the rate that must be met.

Nitrogen oxides emissions have been guaranteed by the Riley Stoker Corporation not to exceed the allowable emission of 0.3 lb/10^6 Btu. This is based on the use of an oversized boiler to maintain flame temperatures below 2600°F. If testing shows higher levels, boiler modifications such as flue gas recirculation could be employed to ensure compliance with the emission regulations. Using an oil with a heat content of 18,500 Btu/lb the NO_x emission rate from a high pressure boiler would be about 71 lbs/hr.

Based on expected operation the peak and annual emissions from operation of the steam boilers is as follows:

SO_2	440 lbs/hr	1,135,600 lbs/yr
NO_x calculated as NO_2	250 lbs/hr	630,280 lbs/yr
Particulates	41 lbs/hr	105,046 lbs/yr

This is based on a maximum hourly boiler firing rate of 45,000 lb/hr and an annual fuel use in the boilers of 14,559,400 gallons.

Incinerator

At this time designs for the incinerator operation have not been finalized. It is expected that the operation will be at 200 to 300% excess air and refuse will be handled in batches. The air contaminant emissions from the incinerators have been estimated from emission factors prepared by the Environmental Protection Agency.[4] For a single chamber incinerator the emissions factors are as follows:

SO_2	2.5 lbs/ton of refuse
NO_2	2 lbs/ton of refuse
Particulates	15 lbs/ton of refuse

Not all of the particulates formed will be emitted since a cyclone type collector will be installed after the incinerator to remove particulates from the flue gases. Collection efficiencies can be expected to exceed 60%. However, in order to be conservative the collection efficiency has been assumed to be 50%.

Emissions from the incinerator to the boilers are as follows:

SO_2	2 lbs/hr.	(14 tons x $\frac{2.5 \text{ lbs}}{\text{ton}}$ x $\frac{\text{day}}{17 \text{ hrs}}$)
NO_2	1.6 lbs/hr	(14 tons x $\frac{2 \text{ lbs}}{\text{ton}}$ x $\frac{\text{day}}{17 \text{ hrs}}$)
Particulates	6.2 lbs/hr	(14 tons x $\frac{15 \text{ lbs}}{\text{ton}}$ x $\frac{\text{day}}{17 \text{ hrs}}$ x 0.50 collection)

It is expected that particulates entering the boiler will be further combusted and that all odors will be eliminated. The multicyclones after the incinerator, the steam boiler and the cyclones after the boilers should eliminate all particles with diameters above 100 microns. The annual quantities of contaminants that could be emitted from the incinerator are as follows based on operation 17 hours a day for 365 days a year.

SO_2	12,410 lbs/yr
NO_2	9,930 lbs/yr
Particulates	38,471 lbs/yr

Total Emissions

The total peak emissions from the facility have been estimated by considering expected combined operation during each month. Peak SO_2 emissions occur during the winter months when there is enough steam to operate the back pressure turbine at full load which in turn reduces the demand from the diesels. Particulate emissions are also highest in winter due to operation of the boilers for steam. Peak NO_x emissions occur during the summer when electrical demand is higher and the back pressure turbine can only be operated at partial load. The peak hourly emissions of SO_2 and particulates will occur when steam production is 677,000 lb/hr, the back pressure turbine generates 10,300 kw and the diesels generate 16,380 kw. Peak hourly emissions of NO_x will occur when steam production is 528,000 lb/hr, the back pressure turbine generates 6,640 kw and the diesels generate 25,360 kw. Emission from the

incinerator should be constant throughout the year. Annual emissions are based on the fuel use in the diesels and boilers of 6,894,000 gal and 14,559,400 gal, respectively. The total peak emissions are as follows:

SO_2	525 lb/hr	1,685,700 lb/yr
NO_x	876 lb/hr	3,525,110 lb/yr
Particulates	54 lb/hr	193,260 lb/yr

At the peak hourly operating condition the flue gas rate will be approximately 900,000 lb/hr at 350°F.

Emission of what is commonly called acid smut should not occur from this facility because of the stack design. Acid smut is an agglomeration of particulates on which sulfur trioxide has condensed thus forming an acidic particle. The formation of this is due to temperatures dropping below the acid dewpoint and collection of particulates in the cold end of boilers or in the stack. When the particles break loose they are carried out of the stack where they are a nuisance. The proposed stack has been designed to operate at temperatures of 360°F with a temperature drop, of 5-30 degrees, depending on the load. This will effectively prohibit the acidification of particulates. Furthermore, the exit velocities of up to 60 fps and continuous operation should keep particulates from collecting inside the stack.

Emissions from the Existing Plant

Estimates of emissions from the existing powerhouse have been made so that the incremental amount of emissions that will result when the new facility begins operation and the existing plant is razed can be determined. Particulate emissions are based on an average of three stack tests conducted on each boiler in January of 1973.[5] Table 5.2.2-2 shows the flue gas flow, heat input and particulate emissions determined during these tests and also estimates of SO_2 and NO_x emissions. The peak emissions would occur if all the existing boilers were operating together. Their emissions would be as follows:

	Existing Plant	Proposed Plant
SO_2	202 lb/hr	525 lb/hr
NO_2	396 lb/hr	876 lb/hr
Particulates	23 lb/hr	54 lb/hr

These emissions are about 2-1/2 times less than those projected by the proposed plant; however, the proposed facility can produce 3 times the amount of steam, 25 times the amount of electricity, 3 times the amount of chilled water and can incinerate 40 tons of refuse per day.

TABLE 5.2.2-2

EMISSIONS FROM THE EXISTING POWER HOUSE

Boiler No.	Flue Gas Flow scfm	Heat Input 10^6 Btu/hr	Measured Particulates lb/hr
1	24,250	53.4	2.89
2	21,065	53.0	5.29
3	17,494	53.4	3.21
4	19,496	59.7	2.19
5	10,156	31.0	2.17
6	18,667	64.1	3.80
7	17,580	58.5	3.26
	128,708	373.1	22.81

Based on heat content of oil of 18,500 Btu/lb about 20,168 lbs of oil would have been burned per hour during the tests with a 0.5% sulfur content the SO_2 emission would have been 202 lbs/hr.

$$\frac{20{,}168 \text{ lbs oil}}{\text{hr}} \times \frac{0.005 \text{ lbs}}{\text{lb oil}} \times \frac{64 \text{ lbs } SO_2}{32 \text{ lbs S}} = 202 \text{ lbs/hr}$$

Based on experience with uncontrolled boilers the NO_x concentration of the flue gas was estimated to 400 ppm. This results in an NO_x emission rate calculated as NO_2 of 396 lbs/hr.

$$\frac{400 \text{ ft}^3 \text{ } NO_2}{10^6 \text{ ft}^3 \text{ flue gas}} \times \frac{46 \text{ lbs } NO_2}{359 \text{ ft}^3 \text{ } NO_2} \times \frac{128{,}708 \text{ ft}^3 \text{ flue gas}}{\text{min.}} \times \frac{60 \text{ min.}}{\text{hr}} = 396 \text{ lbs/hr}$$

Impact on Ambient Air Quality

The air quality impact of the proposed total energy plant has been estimated by using a mathematical model to describe the dispersion and dilution of air contaminants once they leave the stack. This type of atmospheric diffusion modelling has been accepted by the Environmental Protection Agency as an appropriate tool for determining impact of various contaminant sources. Details of the model used in this analysis are presented in Appendix D.

The analysis was done for both peak load and 50% of peak load operating conditions since for some downwind locations a lower load may produce higher ambient concentration due to a lower plume rise which may offset the decrease in emissions. Emissions and exit velocity during these conditions are as follows:

Load	Contaminant	Emission Rate	Exit Velocity
peak	SO_2	525 lbs/hr	60 fps
	NO_2	876 lbs/hr	
	particulates	54 lbs/hr	
50% of peak	SO_2	263 lbs/hr	30 fps
	NO_2	438 lbs/hr	
	particulates	27 lbs/hr	

Ground Level Concentrations

The following discussion is a presentation of the contributions to ambient air quality from the proposed project. Removing the existing power plant will serve to negate the impact of the proposed plant since the existing plant has shorter stacks, less than 186 feet, than the proposed project. The benefits of removing the existing plant have not been shown since the contributions from the proposed plant alone are

only a small part of the air quality standards. It is likely that some areas will have improved air quality upon termination of the existing plant.

SO_2

Maximum contributions to ground level concentrations of SO_2 are listed below and along with the applicable air quality standards.

	Calculated Contribution to Ground Level Concentration		Federal and Massachusetts Standards
	Peak Load	50% of Peak Load	
3-hr av.	.016 ppm	.011 ppm	.5 ppm
24-hr av.	.006 ppm	.005 ppm	.14 ppm
annual av.	.0004 ppm	.0004 ppm	.03 ppm

Contours showing locations of equal levels of annual concentrations are shown in Figure 5.2.2-1 for continuous peak load operation to demonstrate the distribution of concentrations.

The contributions of SO_2 are a small fraction of the standards. When these small additions are combined with the maximum measured ambient 24-hr and annual concentrations of 0.041 ppm and 0.012 ppm, respectively, as discussed in Section 4.1, there should be no contravention of SO_2 air quality standards.

NO_2

Maximum annual contributions to ground level concentrations of NO_2 are listed below along with the applicable air quality standard.

	Calculated Contribution to Ground Level Concentration		Federal and Massachusetts Standards
	Peak Load	50% of Peak Load	
annual av.	.0008 ppm	.0008 ppm	0.05 ppm

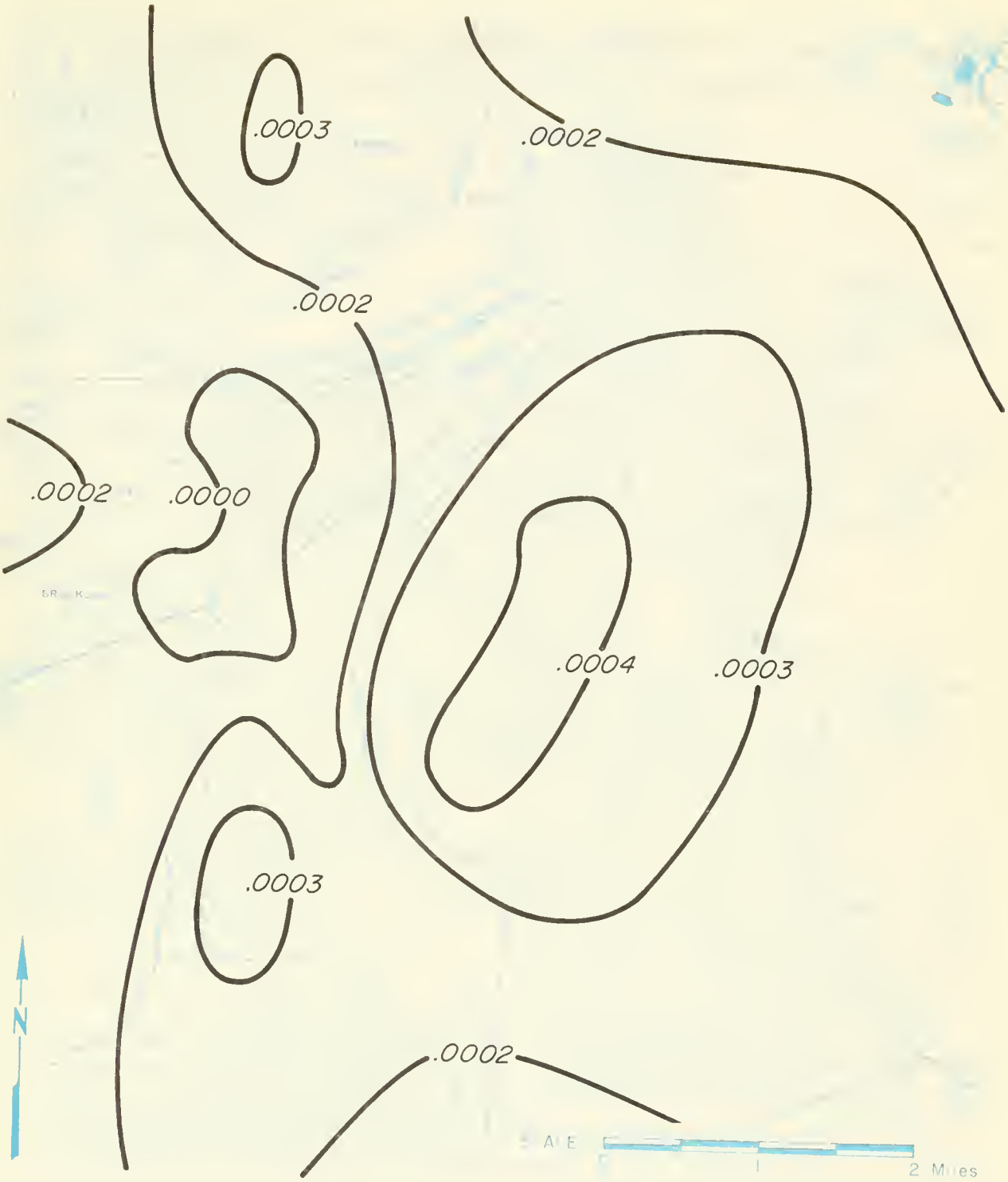

Figure 5.2.2-1 Contours of Annual SO_2 Concentrations (ppm) Contributed by the Proposed Project

Contours of annual concentrations are shown in Figure 5.2.2-2 for continuous peak load operation to demonstrate the distribution of concentrations.

This proposed project would not add significant concentrations to ambient levels. It is not possible to evaluate the overall impact of the project on NO_x levels because of invalid background data as discussed in Section 4.1.

Particulates

Maximum contributions to ground level concentrations of particulates are listed below along with the applicable air quality standards.

	Calculated Contribution to Ground Level Concentration		Federal and Massachusetts Standards
	Peak Load	50% of Peak Load	
24-hr av.	1.7 $\mu g/m^3$	1.30 $\mu g/m^3$	150 $\mu g/m^3$
annual av.	0.11 $\mu g/m^3$	.087 $\mu g/m^3$	60 $\mu g/m^3$

Contours of annual particulate concentrations are shown in Figure 5.2.2-3 for continuous peak load operation to demonstrate the distribution of particulate concentrations.

As discussed in Section 4.1, particulate concentrations in the Boston area have exceeded air quality standards. The proposed project will add to this situation, but not to a significant amount, less than 1.1% of the standard.

The maximum concentrations calculated for SO_2, NO_2 and particulates occur in a range of from 1000 meters to 4000 meters from the site. Direction of occurrence of the short term concentrations have not been presented since the maximum concentrations were combinations of meteorological conditions that would produce peak concentrations irrespective of direction as explained in Appendix D. Examination of the concentrations show that peak load conditions produce higher concentrations at ground level than partial loads.

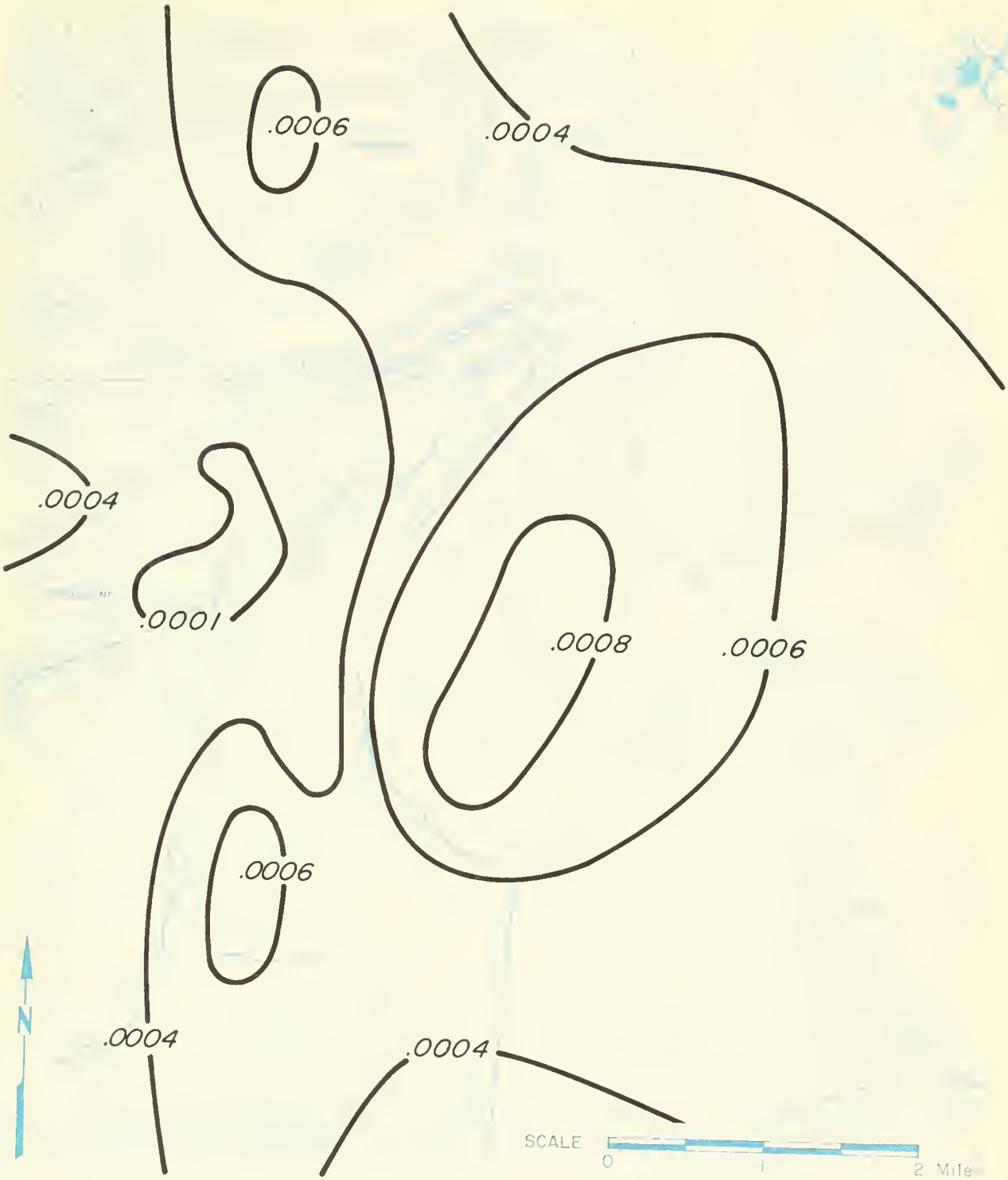

Figure 5.2.2-2 Contours of Annual NO_2 Concentrations (ppm) Contributed by the Proposed Project

Figure 5.2.2-3 Contours of Annual Particulate Concentrations (mg/m^3) Contributed by the Proposed Project

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Concentrations on Parker Hill

Parker Hill is the most prominent terrain feature near the project, approximately 2/3 of a mile to the south rising to an elevation of 200 feet msl. It is a populated area with the New England Baptist Hospital on the top. The air quality impact of the proposed project on Parker Hill was calculated since an elevated area can intercept more of the plume from a single point source and it may thus encounter higher ground level concentrations than level terrain at the same distance.

Air flow over Parker Hill, the initial height of the stack above the hill (135 feet), and the rise of the plume would keep the plume from directly impinging on the side of the hill. However, the distance from the centerline of the plume to the top of the hill would be less than from the centerline to level terrain at the same distance. The influence of air flow on keeping the plume above the surface of an elevated terrain feature is presented in Appendix D.

The following are the maximum concentrations of contaminants contributed to the air quality of Parker Hill from the proposed project:

Contaminant	Averaging Period	Concentration Contributed	Air Quality Standard
SO_2	3 hr. average	0.026 ppm	0.50 ppm
	24 hr. average	0.010 ppm	0.14 ppm
	annual average	0.0002 ppm	0.03 ppm
NO_2	annual average	0.0003 ppm	0.05 ppm
Particulates	24 hr. average	2.5 $\mu g/m^3$	150 $\mu g/m^3$
	annual average	0.07 $\mu g/m^3$	60 $\mu g/m^3$

These concentrations were based on the project operating continuously at peak load all the time and they are, therefore, conservatively high. In comparison to ground level concentrations presented previously, it can be seen that some of the short term contributions are greater than would be received at level terrain but the annual averages are lower due to the predominant southwest wind.

Ground Level and Elevated Concentrations at Elevated Receptors

The medical area contains high rise structures for research, education and health care. Concentrations that would be produced at elevated buildings due to the proposed project have been calculated. Four receptor buildings, their distance from the project and their elevation are as follows:

Name	Distance	Elevation	Height Above the Base of the Stack
Affiliated Hospitals Center (proposed)	100 m.	244 ft	209 ft
Sidney Farber Cancer Center	150 m.	215 ft	180 ft
Children's Medical Center Apartment Building	200 m.	274 ft	239 ft
Children's Hospital Research Building	250 m.	215 ft	240 ft

Concentrations of contaminants at receptor tops have been calculated to determine if high concentrations would occur at elevated windows or air intakes. Both peak load and 50% of peak load conditions were analysed and the concentrations resulting from peak load operation are shown in Table 5.2.2-3· footnotes indicate increases due to partial load operation for the few receptor points for which peak load conditions do not yield the highest possible concentrations.

This table shows that the concentrations contributed are all below air quality standards. Concentrations produced by 50% of peak load showed a small increase only at the Affiliated Hospitals Center and Sidney Farber Cancer Center. At the other receptors the concentrations were about the same or lower than those produced during full load operation.

No assessment was made of the resulting overall air quality at the elevated receptors because the air quality data available is for ground level.

TABLE 5.2.2-3

MAXIMUM CONCENTRATIONS AT IMPORTANT RECEPTORS AT PEAK LOAD

Receptor (distance)	Height at Receptor Above Base of the Stack	SO_2 ppm 3-hr	SO_2 ppm 24-hr	SO_2 ppm Annual	NO_2 ppm Annual	Particulates ($\mu g/m^3$) 24-hr	Particulates ($\mu g/m^3$) Annual
Affiliated Hospitals Center	209 ft	.033**	.010*	.0002***	.0004***	2.76*	0.06***
(330 ft)	0 ft	<.0001	<.0001	<.0001	<.0001	0.00	0.00
Sidney Farber Cancer Center	180 ft	.015**	.006**	.0002***	.0001***	1.67**	0.02***
(500 ft)	0 ft	.0002	.0001	<.0001	<.0001	0.03	0.00
Children's Apartments	239 ft	.087	.025	.0008	.0017	6.64	0.24
(650 ft)	0 ft	.0015	.0005	<.0001	<.0001	0.35	0.00
Children's Hospital Research	240 ft	.037	.013	.0005	.0009	3.52	0.13
Building (820 ft)	0 ft	.004	.001	<.0001	<.0001	0.35	0.00
Applicable air quality standard		.500	.140	.030	.050	150	60

* These values increase by 16% at 50% of peak load.

** These values increase by 10% at 50% of peak load.

*** These values increase by 3% at 50% of peak load.

Concentrations Caused by Plume Downwash

The preceding analysis was for dispersion without including the influence of the buildings in the area on air flow. Air flow in the wakes of buildings can under certain conditions bring the plume from a source to the ground more rapidly than usual and produce increases in short term concentrations in the near vicinity of those buildings. This is a function primarily of stack height and location with respect to nearby buildings. Since for this project Paul L. Geiringer and Associates had the responsibility of designing the stack they worked with Dr. James Halitsky in analyzing building wake effects. Dr. Halitsky's report to Paul L. Geiringer and Associates is attached to this report as Appendix E.

Environmental Research & Technology has reviewed Dr. Halitsky's report and concur with the conclusions that the plume from the project will have little or no interaction with the wakes of nearby buildings.

Prevention of Significant Air Quality Deterioration

The Environmental Protection Agency promulgated rules and regulations for the prevention of significant air quality deterioration to be effective January 1, 1975. These regulations were published in the Federal Register, Vol. 39, No. 235, Thursday, December 5, 1974. The regulations designate all states as Class II, which limits the increase of SO_2 and particulates above the 1974 baseline level to the following amounts:

Particulate matter:

annual geometric mean	10 $\mu g/m^3$
24-hour maximum	30 $\mu g/m^3$

Sulfur dioxide:

annual arithmetic mean	15 $\mu g/m^3$	(.0058 ppm)
24 hour maximum	100 $\mu g/m^3$	(.0384 ppm)
3-hour maximum	700 $\mu g/m^3$	(.268 ppm)

This increase is for an area and is not an allowable limit that each new source can fully produce.

The peak contributions to ground level concentrations of SO_2 and particulates previously calculated are presented again along with the allowable increases.

Particulates	Calculated Increase	Allowable Increase
24-hr av.	1.7 $\mu g/m^3$	30 $\mu g/m^3$
annual av.	0.11 $\mu g/m^3$	10 $\mu g/m^3$

SO_2	Calculated Increase	Allowable Increase
3-hr av.	.016 ppm	.268 ppm
24-hr av.	.006 ppm	.0384 ppm
annual av.	.0004 ppm	.0058 ppm

The proposed project contributes less than 10% to the allowable increase in air quality for the area. It should be noted that removing the existing plant from the area and its associated air contaminant concentrations will reduce the overall effect of the new plant and could improve air quality in some areas.

Cumulative Effects of Other Sources of Air Contaminants

This report has addressed the contribution of the proposed project to air quality; it has not attempted to provide a source inventory of other existing or proposed projects in the area or an overall air quality impact from all the sources. This is because the proposed project by itself would not cause any air quality standards to be exceeded and in fact could improve air quality by the termination of the existing power plant.

Cooling Tower

The cooling tower for the proposed project is not expected to have any adverse effects from the formation of fog, icing or drift because of its design.

The tower has been designed so that the cooling water from the diesels will add enough heat to the air leaving the tower so that it will not be saturated with water vapor. This precludes the visible

vapor plumes that are usually associated with cooling towers. For example, during a summer day when temperatures are 85°F and three water chillers are in operation approximately 4,500,000 Btu/hr would have to be supplied to the air leaving the tower to avoid the visible plume. At the same time three diesel engines would be in operation to meet the electrical demands and would supply approximately 22,500,000 Btu/hr from the jacket cooling water. This is more than adequate for the plume abatement. During cooler days when diesel generation is lower, additional heat may have to be added to the cooling tower to prevent the vapor plume. Because there will be no visible vapor plume the cooling tower will not produce any fog. In fact, it is likely that since the air leaving the tower will be below its saturation point and warmer than the ambient air, it could alleviate the extent of a naturally occurring fog. The tower has been designed based on the conservative estimate that the ambient air entering the tower has a relative humidity of 100%.

The abatement of the visible plume also eliminates the possibility of icing since there will be no uncombined water vapor that can condense. In order for icing to occur, the ambient temperature would have to be 32°F or below and the plume would have to impinge on an object that is colder than the ambient conditions to produce condensation that could freeze.

The cooling tower will produce a small quantity of drift which is the entrainment of water droplets in the air stream that passes through the tower. Since the drift comes from the circulating water as it trickles down through the tower fill it contains the same chemical composition as the circulating water. As the drift evaporates, the chemicals are deposited on the ground as solids. Paul Geiringer and Associates has specified that the drift will not exceed 0.1% of the circulating water flow. At the maximum water flow of 42,840 gpm this would produce a drift rate of 42.8 gpm. It is expected that actual drift rate will be lower since lower rates do occur in cooling towers and the heating coils will act as a drift eliminator to collect some droplets by impingement. However, a drift rate of 42.8 gpm has been used to estimate the impact.

The chemical concentration in the drift is as follows:

Calcium	19 ppm
Magnesium	6.5 ppm
Sodium and potassium	6.15 ppm
Chloride	17.5 ppm
Sulfate (as SO_4)	40 ppm
Carbonate (as $CaCO_3$)	22 ppm
Silica (as SiO)	12.5 ppm
AMP	50 ppm
Quarternary ammonium compound	100 ppm (instantaneous, once a week application, down to 0 in 48 hours)

The total maximum chemical content is 273.7 ppm and this results in an emission rate of solids from the tower of about 0.74 gm/sec.

The transport and location of the final deposition of the drift is dependent on the size distribution of the drift as well as meteorological conditions. Larger drift droplets are deposited closer to their source while smaller droplets may be transported long distances by the wind. Drift size distribution could not be determined for this cooling tower since the jacket water coils will remove some drift and will cause the remaining drift to evaporate before leaving the tower. This will tend to shift particle size distributions found in similarly sized mechanical draft towers to the smaller sizes. This precluded a detailed drift analysis, and an approximation of drift deposition was used.

The concentration of chemicals in the drift averaged over a month to take into account the once a week addition of the quaternary ammonium compound is 174 ppm. Based on the maximum monthly number of cooling degree days and associated cooling demand, the cooling tower will operate at full load less than 50% of the time. These operating characteristics would result in a monthly emission of solids of about 1,380 lbs/month. If the wind blew toward one direction 20% of the time and all the solids fell within 1,000 meters of the tower, the deposition would be 5.7 lbs/acre/month. It is expected that because of actual tower drift rates, evaporation in the tower and travel distances of drift beyond 1,000 meters that this monthly deposition rate is conservatively high. It should be noted that this deposition rate will only occur mainly during the summer cooling season when the cooling requirements

are high. This estimate of solids deposition due to cooling tower drift is about 1/3 of that which has been measured in an urban area.[6] Since the site is an urban area that is also coastal in nature, the normal deposition is expected to be higher so the contribution from the tower would be lower. Because of natural conditions and overly conservative estimate of solids deposition, it is not expected that the proposed project will produce noticeable impact.

Impact from Truck Traffic

Oil delivery and ash removal trucks serving the energy plant will be the source of carbon monoxide hydrocarbons and photochemical oxidants. An analysis of the emission and their effect has not been conducted since trucks' visits will not occur all at the same time and the daily number of trucks is a small percentage of traffic along Longwood and Brookline Avenues. Furthermore, the annual increase of oil delivery trucks will be about 2,000 and this will be offset by the reduction of 5,200 trash trucks traveling through the area.

References for Section 5.2.2 Air Quality

1) Standard of Performance for New Stationary Sources, Federal Register, Vol. 36, No. 247, Thursday, December 20, 1971 and updated in the following Federal Registers:

   Vol. 39, No. 177, Wednesday, September 11, 1974
   Vol. 39, No. 116, Friday, June 14, 1974
   Vol. 39, No. 47, Friday, March 8, 1974
   Vol. 37, No. 166, Friday, August 25, 1972

2) Personal communication between Environmental Research & Technology, Inc. and White Fuel Oil Company, Boston, Massachusetts, October 1974.

3) Environmental Protection Agency, "Stationary Internal Combustion Engines in the United States", EPA-R2-73-210, April 1973.

4) Environmental Protection Agency, "Compilation of Air Pollutant Emission Factors", AP-42, April 1973.

5) Emission Tests by Eli Bulba Company, Boston, Massachusetts, January 1973.

6) Pearson, R. J. and D. W. Fisher, "Chemical Composition of Atmospheric Precipitation in the Northeastern United States", Geological Survey Water Supply Paper, 1535-P, 1971.

5.2.3 Hydrology

Although the future paved-unpaved acreage for the proposed total energy plant site has not been finalized, it is likely that there will be no significant unpaved area. Therefore, it is assumed that the entire site will be paved. Peak runoff rates for both the present paved-unpaved acreage of the site and the future paving of the site were calculated for a 10-year design storm, rainfall rate of two inches per hour. Runoff coefficients for paved and unpaved acreage were 1.0 and 0.3, respectively. Thus, maximum surface runoff rate of 2.57 cfs for a 10-year design storm is projected for the proposed site occupied by the plant. This is compared to a maximum rate of 1.58 cfs for the present site utilization. The peak discharge flow of the Muddy River for a 10-year design storm is estimated to exceed 400 cfs. Therefore, incremental increase of 0.99 cubic feet per second in the peak runoff rate for a 10-year design storm will have an insignificant impact on the hydrology of the Muddy River.

The project area is not subject to inundation from flood crests of the nearby Muddy River. During the damaging flood of August 1955, when the Charles River Basin rose 4.5 feet above normal to a record elevation of 6.9 feet msl, the Muddy River attained a maximum elevation of 12.3 feet msl, a full 8 feet below the 20 foot msl elevation of the project border along the Riverway. In all floods occurring both subsequent and prior to the flood of 1955, the maximum water level in the Muddy River fell below 12.3 feet msl. Since the site area lies well above the high water marks attained during each of these floods, it is not located in the flood-plain zone and not subject to flooding from bank overflow.

5.2.4 Water Quality

It is anticipated that the quality of the runoff from the proposed facility site will be improved compared to that which exists now because of the following three features: 1) non-utilization of the site for automobile parking; 2) general utilization of concrete for all paved surfaces; and 3) installation of a "closed position" drainage valve at the

fuel oil unloading area. The removal of site parking, about 45 spaces along Peabody Street and in the alley behind the existing buildings, will eliminate a source of heavy metals, oil and grease, and petroleum additives to the localized runoff. General utilization of concrete in lieu of asphalt or petroleum-based materials for the paved surfaces will prevent the formation of surface petroleum films often seen on asphalt during the summer months. Installation of a "closed position" drainage valve dock at the fuel oil unloading area will eliminate contamination of storm runoff through either a spill or chronic dripping from the trucks.

The oil handling facility has been designed to preclude the possibility of an oil leak or spill. Both high and low level alarms will be installed on the oil tanks to indicate oil level. The unloading area will also contain warning signs concerning hose disconnection procedures. If any oil should be released it will be contained and collected for return to oil trucks or the oil tanks, and the oil unloading area will be able to hold the entire contents of a truck in case of a major incident. A drainage valve will be in a depression in this area and will always be closed until any oil removal is completed. Oil collected from water and sediment drained from the tanks will be injected into the fuel oil supply to the boilers and burned. Any equipment cleaning water and floor washing water containing petroleum residues will also be injected into the fuel oil supply to the boiler.

The oil tanks are being designed to accommodate settling and variations in weight due to changes in oil content. This will eliminate any cracks or ruptures. Since the tank material will be concrete there is no chance for corrosion to allow oil to escape. The No. 2 oil and lube oil will be stored in fiberglass tanks within a concrete vault for oil spill prevention.

The sanitary wastewater load from the proposed facility will be approximately 500 gallons per day (calculated for 10 toilets at 50 gallons per day per toilet). This is much less than the estimated sanitary wastewater load of 22,900 gallons per day for the present site utilization. The proposed sanitary load will have an insignificant impact upon the Deer Island Treatment Plant and Boston Harbor since it is less than 0.1% of the dry-weather day-to-day flow variation of the treatment plant.

Prior to operation of the proposed facility, it will be necessary to clean the boilers and the entire piping system. It is anticipated that the cleaning solution used will contain .25 lb commercial detergent (disodium phosphate), 1 lb caustic soda, and 1 lb soda ash for each thousand pounds of water held within the system. This will result in an alkaline solution with a pH of 10-12. The cleaning process will be handled by an approved contractor, who will be responsible for the proper disposal of the cleaning solution. It is likely that these washes will be trucked off site for disposal. Waterside and fireside washing of the boiler should not be necessary on a regular basis, and may occur only once or twice in the life of the equipment.

The total yearly water demand for the proposed facility is estimated to be up to 97,000,000 gallons. The estimated water consumption for the City of Boston in 1975 is 53,290,000,000 gallons. Thus, the proposed project would account for .2% of Boston's yearly water consumption for the year 1975. Maximum daily water consumption, which will occur in the summer months, is estimated to be about 1,250,000 gallons per day. This figure is the result of 22,000 gallons per day of boiler makeup, 1,209,600 gallons per day of cooling tower makeup blowdown, and 28,000 gallons per day for makeup of steam condensate loss. The maximum daily consumption for the City of Boston (which will occur during the summer months) for the year 1975 is estimated to be 167,000,000 gallons per day. Thus, the proposed project could account for .75% of Boston's maximum daily water demand for the year 1975. Almost all of the proposed facility's water demand will be used for providing space cooling and space heating which are traditional usages for a domestic water supply. The incremental yearly and maximum daily water demands of the proposed facility will not alter the Metropolitan Water District's current ability to satisfy its municipal members' water demands. The proposed facility will also not alter the future supply capability of the MWD if the river water diversion projects discussed in Section 4.3 are implemented. Pressure tests will be conducted by the City of Boston to determine the maximum allowable water use rate. Water consumption rates for the existing plant have not been determined but termination of that plant will reduce the incremental effect of the proposed plant. Since there is a 42 inch water main along Huntington Avenue and a 36 inch main along Brookline Avenue, it is not expected that the project would affect water pressure in the area. Low water pressure that exists in

Mission Hill could be due to old, inadequate or blocked water lines from the mains to individual areas and homes. This is a problem unrelated to the project and one which the City would have to correct.

It is anticipated that the cooling tower chemical treatment system will utilize the following two chemical groups: aminomethylene-phosphonates and dialkyl quaternary ammonium compounds. Aminomethylene-phosphonate (AMP) is a "third-generation" anti-scalant designed to supplement or replace treatment systems employing zinc or chromate compounds. The compound is low in toxicity, and does not break down into poly- or orthophosphates (an algal nutrient) in the degradation process. The AMP compound will be applied continuously in order to maintain a cooling tower concentration of approximately 50 ppm. The dialkyl quaternary ammonium compounds are used for controlling algae and bacterial slime buildup (microbiocide and slimicide). It is slug fed to the cooling tower system once a week to attain an instantaneous initial concentration of 100 ppm. Due to the continuous addition of makeup water to the cooling tower, the biocide is of such low concentration that it is undetectable in the cooling tower water 48 hours after the slug operation. The biocide is 98% biodegradable. Although the dialkyl quaternary ammonium compounds are toxic to fish at the level of the initial cooling tower slug concentration, the incremental concentrations of the compounds when discharged to Boston Harbor will not be toxic to fish. Neither of the two chemicals will affect any of the treatment processes in the Deer Island Treatment Plant, and neither of the two chemicals will affect the phytoplankton or macro-aquatic ecology of Boston Harbor in the concentrations discharged from the treatment plant.

In addition to the two chemicals discussed above, the cooling tower blowdown will contain the original salts in the MDC water supply concentrated by a factor of 3.5-5.0 due to continuous cycles of evaporation from the cooling tower. A listing of selected salt ions measured at the Quabbin Reservoir outlet (the main MDC supply source for the City of Boston) is given in Table 5.2.4-1. The concentration ranges of these selected ions in the blowdown are also given in Table 5.2.4-1. The Quabbin water contains only small amounts of dissolved salts, and is particularly low for the calcium, magnesium, sodium, and potassium ions. Increasing these concentrations by a factor of 3.5 to 5 still results in low salt levels in the blowdown water. These low

TABLE 5.2.4-1

CONCENTRATIONS OF SELECTED SALT IONS IN QUABBIN RESERVOIR
AND IN PROPOSED COOLING TOWER BLOWDOWN

Parameter	In Quabbin R.[1] (ppm)	In Blowdown at 3.5-5 cycles of concentration (ppm)
Calcium	3.8	13.3 - 19.0
Magnesium	1.3	4.55 - 6.5
Sodium and Potassium (as No.)	1.23	4.31 - 6.15
Chloride	3.5	12.25 - 17.5
Sulfate (as SO_4)	8.0	28.0 - 40.0
Carbonate (as $CaCO_3$)	4.4	15.4 - 22.0
Silica (as SiO)	2.5	8.75 - 12.5

[1]Note: all values are 1973 averages, except carbonate, which was given for April, 1974.

salt levels will have no significant impact upon either the Deer Island Treatment Plant or Boston Harbor since the total dissolved salt level in the blowdown is less than that of sanitary sewage.

The operating range for pH in the proposed cooling tower system will be 6.8-9.0. Due to the excellent quality of the MDC supply, it is anticipated that the pH will not increase above 7.5. The energy plant will be in compliance with Metropolitan District Commission Regulations for sewage discharges.

Both the sanitary wastes and the blowdown generated by the proposed facility will flow across the Muddy River to a large Brookline sewer which runs parallel to the M.B.T.A. Riverside line until it intersects Carlton Street. The wastes then will flow to the connection with the MDC Charles River Valley sewer at the intersection of St. Mary's Street and Commonwealth Avenue. The Town of Brookline has recently completed a series of projects to separate storm water drainage from sanitary discharge for the sewer in question. The latest project involved storm water/sanitary wastewater segregation at a park near the intersection of the sewer with the Riverside line (near Aspinwall Avenue). At the intersection of the Brookline sewer with the MDC sewer, there are two tide gates for discharge of combined sewage flow during periods of stormwater overflow. Completion of the South Charles Relief sewer, which was designed to intercept the flow resulting from a five-year storm, has reduced the occurrence of overflow from the Charles River Valley sewer. It is presently planned to divert any overflow from this system to a storm water detention and chlorination station which is being constructed near the B. U. bridge. Excess flows from the Brookline and South Charles systems will be discharged to the Charles River Basin after settling and chlorination. The frequency of overflow to the retention basin has been estimated to be 22 times per year with durations ranging from one to 13 hours.

Neither the salt concentrations nor the pH of the blowdown will generate a significant impact upon the Muddy River or Lower Charles River during periods of stormwater overflow. The concentrations of both AMP and the quaternary ammonium compound group which would be discharged to the Muddy River and/or Lower Charles River during periods

of stormwater overflow cannot be calculated due to a lack of knowledge concerning the multiple overflow discharge points and their respective flows in response to different storm events.

Although the proposed total energy plant does not come under the 1972 Water Pollution Control Act point source category for steam electric power generation because its diesels do not generate electricity using steam, it is expected that the discharge from the proposed facility will be evaluated by comparison to new source pretreatment standards for the steam electric power generating point source category. The pretreatment standards for discharge to a publicly owned treatment works by a new source in this category are given in 40 CFR 128.13 (November 8, 1973), 40 CFR 423.15, and 40 CFR 423.16 (October 8, 1974). These sections are listed in Table 5.2.4-2. In general, the pretreatment standards for new sources are the regular steam electric standards of performance for new sources plus the general pretreatment standards given in 40 CFR 128.131. The cooling tower blowdown will meet the general pretreatment standards because:

a) It will not create a fire or explosion hazard in the publicly owned treatment works.

b) It will not contain wastes with a pH of less than 5.0 nor cause corrosive structural damage to the treatment works.

c) It does not contain solid or viscous wastes in such amounts as to obstruct flow in sewers or interface with the treatment works.

d) The blowdown will not occur at a flow rate and/or pollutant discharge rate which will upset the Deer Island Treatment Plant.

The cooling tower blowdown will meet 40 CFR 423.15 and .16 because:

a) The pH will be within 6.0-9.0.

b) There will be no discharge of polychlorinated biphenal compounds.

c) There are no materials added for corrosion inhibition.

d) There is no limitation on heat as a pretreatment standard.

TABLE 5.2.4-2

FEDERAL NEW SOURCE PRETREATMENT STANDARDS FOR STEAM ELECTRIC POWER GENERATING POINT SOURCE CATEGORY

§423.15 Standards of performance for new sources.

The following standards of performance establish the quantity or quality of pollutants or pollutant properties, controlled by this section, which may be discharged by a new source subject to the provisions of this subpart:

(a) The pH of all discharges, except once through cooling water, shall be within the range of 6.0-9.0.

(b) There shall be no discharge of polychlorinated biphenol compounds such as those commonly used for transformer fluid.

(c) The quantity of pollutants discharged from low volume waste sources shall not exceed the quantity determined by multiplying the flow of low volume waste sources times the concentration listed in the following table:

Effluent characteristic	Maximum for any one day	Average of daily values for thirty consecutive days shall not exceed
TSS	100 mg/l	30 mg/l
Oil and Grease	20 mg/l	15 mg/l

(d) The quantity of pollutants discharged in bottom ash transport water shall not exceed the quantity determined by multiplying the flow of bottom ash transport water times the concentration listed in the following table and dividing the product by 20:

Effluent characteristic	Maximum for any one day	Average of daily values for thirty consecutive days shall not exceed
TSS	100 mg/l	30 mg/l
Oil and Grease	20 mg/l	15 mg/l

(e) There shall be no discharge of TSS or oil and grease in fly ash transport water.

(f) The quantity of pollutants discharged from metal cleaning wastes shall not exceed the quantity determined by multiplying the flow of metal cleaning wastes times the concentration listed in the following table:

Effluent characteristic	Maximum for any one day	Average of daily values for thirty consecutive days shall not exceed
TSS	100 mg/l	30 mg/l
Oil and Grease	20 mg/l	15 mg/l
Copper, Total	1.0 mg/l	1.0 mg/l
Iron, Total	1.0 mg/l	1.0 mg/l

TABLE 5.2.4-2 (Continued)

(g) The quantity of pollutants discharged in boiler blowdown shall not exceed the quantity determined by multiplying the flow of boiler blowdown times the concentration listed in the following table:

Effluent characteristic	Maximum for any one day	Average of daily values for thirty consecutive days shall not exceed
TSS	100 mg/l	30 mg/l
Oil and Grease	20 mg/l	15 mg/l
Copper, Total	1.0 mg/l	1.0 mg/l
Iron, Total	1.0 mg/l	1.0 mg/l

(h) The quantity of pollutants discharged in once through cooling water shall not exceed the quantity determined by multiplying the flow of once through cooling water times the concentration listed in the following table:

Effluent Characteristic	Maximum Concentration	Average Concentration
Free available chlorine	0.5 mg/l	0.2 mg/l
	Maximum for any one day	Average of daily values for thirty consecutive days shall not exceed
Materials added for corrosion inhibition including but not limited to zinc, chromium, phosphorous.	No detectable amount.	No detectable amount.

(j) Neither free available chlorine nor total residual chlorine may be discharged from any unit for more than two hours in any one day and not more than one unit in any plant may discharge free available or total residual chlorine at any one time unless the utility can demonstrate to the regional administrator or state, if the state has NPDES permit issuing authority, that the units in a particular location cannot operate at or below this level of chlorination.

(k) In the event that waste streams from various sources are combined for treatment or discharge, the quantity of each pollutant or pollutant property controlled in paragraphs (a) through (j) of this section attributable to each controlled waste source shall not exceed the specified limitation for that waste source.

423.16

For the purpose of this section, 40 CFR 128.133 shall be amended to read as follows:

In addition to the prohibitions set forth in 40 CFR 128.131, the pretreatment standard for incompatible pollutants introduced into a publicly owned treatment works shall be the standard of performance for new sources identified in 40 CFR 423.15 except for the following pollutants or pollutant parameters for which the following pretreatment standards are established:

TABLE 5.2.4-2 (Continued)

Pollutant or pollutant parameter:	Pretreatment standard
Heat	No limitation.
Free available chlorine	Do.
Total residual chlorine	Do.

If the publicly owned treatment works which receives the pollutants is committed, in its NPDES permit, to remove a specified percentage of any incompatible pollutant, the pretreatment standard applicable to users of such treatment works shall, except in the case of standards providing for no discharge of pollutants, be correspondingly reduced in stringency for that pollutant.

§128.131 Prohibited wastes.

No waste introduced into a publicly owned treatment works shall interfere with the operation or performance of the works. Specifically, the following wastes shall not be introduced into the publicly owned treatment works:

(a) Wastes which create a fire or explosion hazard in the publicly owned treatment works.

(b) Wastes which will cause corrosive structural damage to treatment works, but in no case wastes with a pH lower than 5.0, unless the works is designed to accommodate such wastes.

(c) Solid or viscous wastes in amounts which would cause obstruction to the flow in sewers, or other interference with the proper operation of the publicly owned treatment works.

(d) Wastes at a flow rate and/or pollutant discharge rate which is excessively over relatively short time periods so that there is a treatment process upset and subsequent loss of treatment efficiency.

* 40 CFR 423.15 and .16, October 8, 1974.
  40 CFR 128.131, November 8, 1973.

If chlorine is used as a biocide instead of the dialkyl quaternary ammonium compounds, the cooling tower blowdown will meet Section 423.16 because there is no limitation on either free available chlorine or total residual chlorine. Since all collected fly ash and bottom ash will be transported dry, there will be no discharge of fly ash or bottom ash transport water. Boiler blowdown will occur at a rate of 15 gallons per minute. No chemicals will be added to the boiler water. Therefore, the boiler blowdown will contain only salts concentrated from the water supply source, and will meet the effluent limitations in Section 423.15(g).

5.2.5 Geology and Geohydrology

The only geological impacts of the project in the operational sense are the commitment and utilization of the land itself and the emplacement of foundation materials which could be expected eventually to outlive the useful life of the facility. Some foundations from the present or older dwellings may also be left on the site, but neither these nor the project additions should have more than a minimal impact on any future uses for this land.

With regard to the geohydrology, very little unpaved land will be left, thus net infiltration should remain essentially unchanged. Since the project will penetrate neither the water table nor the deeper, more permeable sands, the groundwater flow in the area should remain fundamentally unperturbed. The storage of large amounts of fuel oil in subsurface tanks does pose a potential risk for contamination of ground water if a leak should occur. This risk has been lessened by placement of the tanks so as to maximize the thickness of (low permeability) clays beneath them, thus minimizing flow rates in the event of a failure. Fuel oil from an undetected, uncontrolled tank failure would be expected to migrate laterally and downward (as the fuel head permitted displacement of the underlying water table) until reaching the permeable sands. More rapid transport through these sandy horizons would be anticipated with movement to the west and northwest, entering the waters of the Muddy River (and subsequently the Charles River Basin) after a subsurface flow of approximately one-eighth of a mile. None of the

operation phase impacts are expected to be severe in magnitude and all adverse impacts and operational concerns are amenable to the application of mitigating and control measures.

5.2.6 Noise

Criteria for Determining Noise Impact

Noise impact may be judged with reference to two criteria. First, projected noise levels for a new project must not exceed the relevant federal, state or local standards or regulations. A second measure of impact recognized by noise analysts is the change in noise level above the existing ambient, which results from the planned development. This latter type of measure would be appropriate where the preservation of existing serenity and quiet is essential for the area to continue to serve its intended purpose. Both types of impact have been investigated for the Masco Energy Plant project.

Noise Regulations

The two standards which are applicable to this project are contained in: (1) the "Regulations for the Control of Air Pollution", adopted by the Commonwealth of Massachusetts, Department of Public Health; and (2) the "Regulation for the Control of Noise in the City of Boston", adopted by the City of Boston Air Pollution Control Commission. The state standards require projected octave band sound pressure levels resulting from the proposed project, but do not stipulate maximum allowable levels. The Boston Air Pollution Control Commission (BAPCC) standards stipulate maximum noise levels according to zoning districts established by the zoning code of the City of Boston. These maximum allowable levels are reproduced in Table 4.5-2.

If a planned development causes an increase in the existing ambient noise level, even though the projected noise levels are within the statutory maximum levels, an intrusion or impact in residential communities, schools, hospitals, convalescent homes and other sensitive receptors will be perceived. In some cases, the existing ambient levels are already

at or slightly above the prescribed maximum levels. In those cases, a realistic assessment of impact would be based on the quantitative increase, if any, above the existing noise levels.

Empirical studies have shown that people in an urban environment can begin to distinguish changes in noise level of approximately 5 dBA.* Thus, changes in noise levels less than this amount may be considered insignificant.

The State of Massachusetts guidelines allow a maximum increase in broadband noise level of 10 dBA above the existing background, with the provision that a puretone condition does not exist.

Noise Sources

During operation of the total energy plant, possible sources of noise affecting the neighboring community include the cooling tower, plant equipment, stack steam release and trucks for oil delivery and ash removal.

The operation of the Total Energy Plant can be expected to lower noise levels below the existing levels in certain parts of the community because:

1) The existing power plant on Blackfan Street will be decommissioned, thereby lowering noise levels in its vicinity.

2) Trash removal services for the institutional area will be reduced or completely eliminated, thereby reducing some heavy truck traffic.

3) The improved cooling tower design of the proposed Energy Plant will result in a smaller zone of impact than that of the existing power plant.

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* Under controlled laboratory conditions, level changes in a pure tone of 2-3 dB can be barely detected, with a 5 dB change readily noticeable. A 10 dB increase is judged by most people as a doubling of sound loudness. From Fundamentals and Abatement of Highway Traffic Noise, prepared for FHWA by Bolt, Beranek and Newman, Inc., June 1973.

All the sources are examined in more detail in the succeeding paragraphs.

Cooling Tower Noise

The sources of noise in cooling towers are due to the fan operation and water spray breakup. Louvered air inlets provided in the side walls of conventional crossflow cooling towers such as the type used on the existing power plant provide little or no obstruction to the part of fan noise directed downward from the fan disc nor to the water noise. On the exhaust side, the noise is predominantly due to the fan.

In the case of the cooling tower for the proposed energy plant, the bulk of the air will be drawn through a plenum connected to the air leaving the power plant during ambient temperatures above 60°F. This will virtually eliminate increases in sound levels during the summer months from the intakes of the cooling tower. During low outside temperature conditions, cooling tower operation will be limited to two cells instead of four. The cooling air will be then drawn through acoustically treated intakes on the Brookline Avenue side of the tower.

The four 50 ft x 50 ft cells of the cooling tower that will be operating are arranged to form a 200 ft x 50 ft rectangle at the Brookline Avenue end of the plant building. The top of the cooling tower is estimated to be 90 ft above street level. This cooling tower will be of the counterflow design which brings air in through the bottom of the tower. This is in contrast to the cooling towers of the existing plant which are crossflow towers requiring air to enter from the side. Counterflow towers are inherently quieter than crossflow designs since the sides of the tower limit water noises. At night or during periods of lower cooling requirements cells can be taken out of operation thus reducing noise levels generated.

Specifications for the cooling tower require sound pressure levels not to exceed 50 dBA at the boundaries of the building. This specification plus the operating characteristics of the tower allow ambient noise levels to decrease after the existing cooling towers are removed.

During the daytime the background levels described in Section 4.5, 58 to 68 dBA along Francis Street, will make the cooling tower inaudible and, in fact, replacement of the existing cooling tower will improve sound levels.

During the night those areas now experiencing sound levels from the existing cooling towers will experience lower sound levels when the proposed plant replaces the existing plant. At those areas further rmeoved from the existing plant the new cooling tower will be inaudible.

Plant Equipment Noise

Due to complexity of determining combined noise outputs of various types of equipment in the plant, the approach taken has been to specify maximum noise levels in the plant building to satisfy the BAPCC nighttime outdoor noise requirement at the site boundary. The nighttime outdoor sound level will not exceed 50 dBA.

Figure 5.2.6-1 shows octave band levels of noise at the walls inside the building that will produce a noise level of 50 dBA outside the wall, conforming with the BAPCC spectrum for nighttime residential noise levels. These levels are based on sound insulation data for (a) 9-inch thick brick wall with a 1/2-inch thick layer of plaster on each side and (b) for solid concrete wall with plaster having a total thickness of 16 inches.[1] Also shown for comparison is the contour for 90 dBA equivalent A-weighted sound level for determining compliance to OSHA standards and the Walsh-Healey Public Contracts Act by the Bureau of Labor Standards, U. S. Dept. of Labor. Since interior noise levels will be maintained to meet the Walsh-Healey Guideline noise criteria for 8-hour exposure by enclosing the diesel room, the exterior noise levels will not exceed the BAPCC Guidelines if 9-inch masonry or equivalent construction giving a STC* rating of 52 is employed for the walls.

Design of the plant ventilation air intakes will determine how much sound will be transmitted outdoors through the intakes. Baffled intakes that do not take a direct route to the engines will prevent the plant from creating any problems. This area will be quieter after the new plant replaces the existing one.

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* STC = Sound Transmission Class - a single figure rating which provides an estimate of the airborne sound insulating performance of buildings, in accordance with ASTM E90-66T.

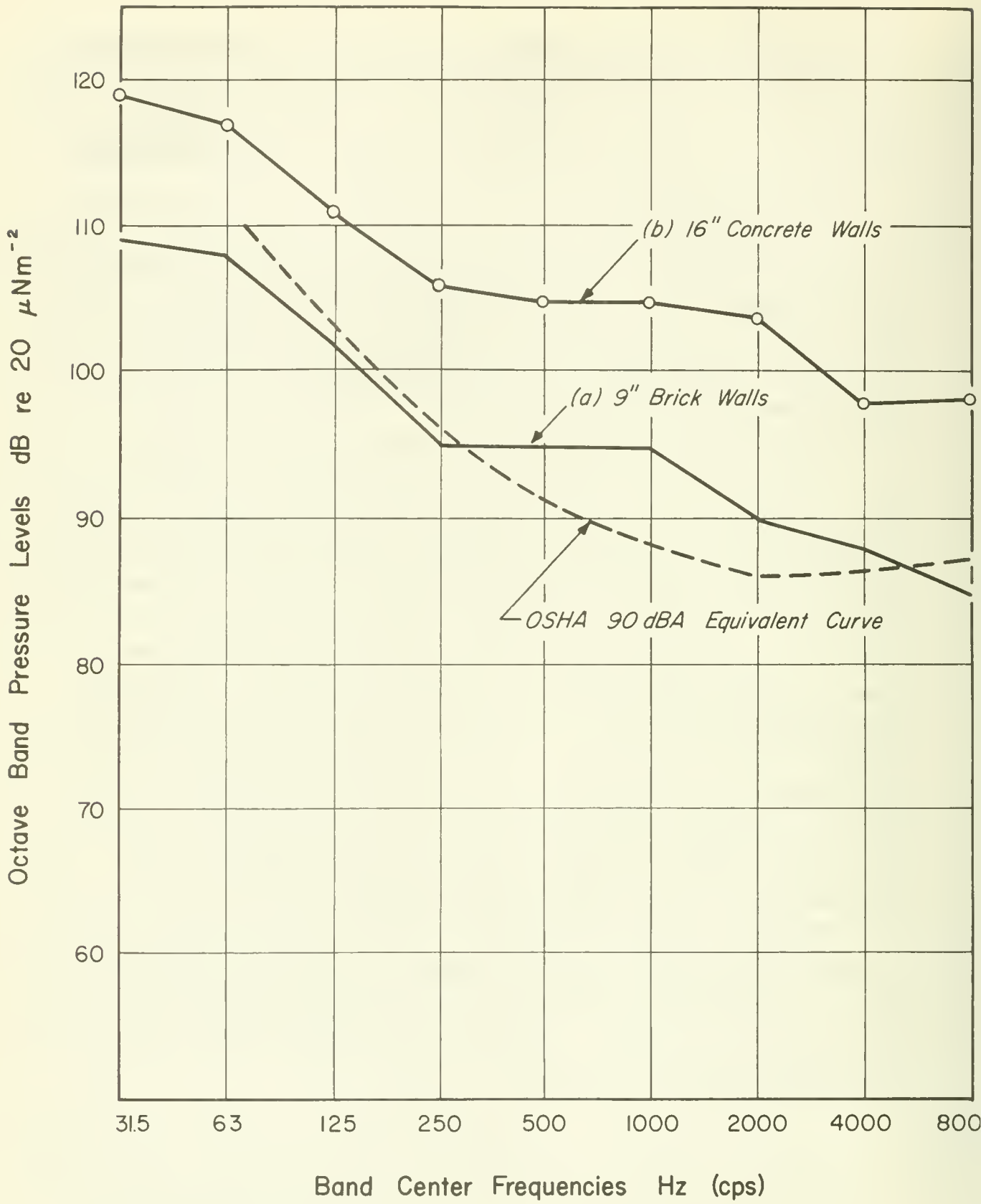

Figure 5.2.6-1 Maximum Permissible Octave Band Sound Levels Inside the Energy Plant

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Noise Radiated from the Stack

Due to the height of the stack, noise emissions from the stack will be far below the background noise levels during operation of the energy plant.

Steam Release Noise

There may be one initial steam release episode when the plant is put into operation. Notices will be posted in the community in advance of this preplanned event so that the problem of startling the community residents and institutional users will be minimized. Release of steam in emergencies may temporarily exceed the noise regulations. However, all precautions have been taken in the design of the plant to minimize the possibility of such an occurrence.

Truck Noise Resulting from the Plant

Fuel will be delivered to the energy plant on a regular basis which will create an increased flow of truck traffic along certain routes leading to the loading ramp on Binney Street. Since the unloading area is enclosed, the major noise impact will be produced by movement of the trucks to and from the site.

As noted in Section 4.5, the mix of trucks on arterial routes has a profound influence on the background and percentile noise levels in adjacent communities. However, the increase of truck traffic expected due to the energy plant operation will be up to 8 trucks per day depending on monthly fuel use. This increase will not affect the background levels but may produce a measurable increase in noise during the passage of each truck. Using the EPA noise limits for heavy trucks of 86 dBA at 50 ft under acceleration as a guideline, the apartments on Francis Street, near Binney Street, will be subjected to levels of 84 to 86 dBA when trucks are turning onto either street or are leaving the loading area. This level could interfere with normal conversation in residences as the truck passes. Attenuation by windows in residences and in the adjacent hospitals would reduce the impact. It should be noted that this type of impact is common in urban areas and that heavy

trucks currently travel on Francis Street, Brookline and Huntington Avenues. With the completion of the Mission Park Housing Development, the residential block south of the site will be used for a parking garage and service center after the residents are relocated. This will reduce the number of residential receptors of truck noise.

The oil unloading and other delivery operations will be confined to an enclosed area on the Binney Street side of the energy plant. Special doors are provided in this area to reduce the transmission of noise to the outside from trucks and loading of ash.

References for 5.2.6 Noise

1. "A Guide to Airborne, Impact and Structure Borne Noise-Control in Multifamily Dwellings" - HUD Document, available from Supt. of Documents, U. S. Government Printing Office, Washington, D. C. (September 1967).

5.2.7 Ecology

The proposed energy plant site is situated in an urbanized environment with limited wildlife habitat. Operation activities of the energy plant will have minimal effects on the surrounding biota. The emission levels of the power plant complex meet EPA air quality criteria and cooling tower drift will be neither strongly acidic or alkaline (pH 6.5-7.5). Therefore, operations will not detrimentally affect the biota other than that caused by original destruction of wildlife habitat during site development.

5.2.8 Social and Economic Characteristics

Community Perceptions

Based on discussions with individuals in the community it was felt that residents of the area generally do not want the facility. This

attitude seems to be based on a general concern which regards any non-residential building as another confirmation of a movement which seeks to engulf the people, increase speculation and out-migration, and eventually render the community homeless. Moreover, the leaders see the plant as potentially increasing air pollution and traffic (eventually necessitating the widening of streets), as probably being unattractive, and as possibly precipitating an increase in their utility bills. Conservation groups voice the additional concern that the Muddy River, including the recreational area at its shores, will be subjected to sewage overflow.

Impact

There is no reliable method for determining the effect the proposed plant would have on speculation and/or out-migration. However, it should be noted here that the Mission Park Housing Development will be constructed in the vicinity. It will add more than 774 new dwelling units to Mission Hill's current housing stock and its residents are expected to retain the general socio-economic profile of the neighborhood. This project is being made possible by the Community Developer and Harvard University.

Traffic congestion and residential parking inadequacies are continuing irritants to the people who live in Mission Hill. The proposed facility is perceived as being responsible for augmenting the influx of trucks which threaten increased danger for both pedestrian and vehicular traffic and increase the existing congestion in the area of the project. However, since the plant will handle the trash from the institutions and Mission Park Housing Project's trash, there will be a reduction in truck traffic that will more than offset the increase in oil trucks. Thus, there should be a net reduction in traffic in the area.

Noise will serve as another kind of disturbance to the community's life style. While oil and ash removal trucks will not invade the bulk of the residential section of Mission Hill, they will be on Francis Street between Brookline Avenue and Binney Street. The maximum noise from these trucks, 84 to 86 dBA at a distance of 50 feet, will be experienced as they turn onto and off of Francis Street. This disturbance

will be offset by the reduction of 5200 trash trucks to about 52 trash trucks needed by the institution. The replacement of residential dwellings south of the site with MASCO's proposed service center would relocate residential receptors to the Mission Park Housing Development. This relocation has been planned with the Roxbury Tenants of Harvard.

Although the proposed plant design is larger in size than the present plant, the architect and developer are making efforts to guarantee that it will be architecturally compatible with the area. The design will go through the open forum of the 121A review process and the result should be a blend of ideas. It is expected that the addition of the plant closer to the residential areas will be seen by the residents as institutional encroachment.

Because of the anti-institutional feeling in Mission Hill, the introduction of another institutional building could have an emotional impact on the residents.

Effect on Boston Edison Rates

The effect on Boston Edison's rates when the total energy plant goes into operation has been considered in order to determine the economic impact on consumers. Since the setting of public utility rates is a very complex process depending on the various classes of users, it is difficult to accurately predict the impact of the proposed project on electric rates. Furthermore, no influence of the project would be realized until 1978 when the plant becomes operational and Boston Edison's costs and sources of revenues could not be predicted for 1978 or future years. However, an examination of Boston Edison's 1974 annual report was made by MASCO to see how current figures would have been changed by the proposed project.

The Boston Edison Territory peak hourly demand was 1,891 Mw (1,891,000 Kw). If the total energy plant had been supplying all the electrical needs of the institutions, the peak would have been about 32 Mw (32,000 Kw) less, resulting in a decrease of about 1.7%. Similarly, the total electricity sold in Boston Edison's territory in 1974 was 9,028,402,000 Kwhr. If the energy plant had been in operation, this quantity would have been reduced by about 156,870,000 Kwhr, a decrease of about 1.7%.

It is expected that these decreases would be offset by growth within the Boston Edison system since electrical consumption in the Edison territory has increased in each of the four years preceding 1974. It is recognized that consumption decreased in 1974 over 1973 levels probably as a result of energy conservation and increasing electric bills due to the increased cost of fuel that was passed on to the customers. (The cost of fuel in 1974 was over 2.4 times the cost in 1973.) Page 25 of Edison's annual report is presented in Table 5.2.8-1 for comparison of consumption by year.

Another important point is that Boston Edison has not expanded its generating and distribution system in order to only serve the medical institutions. Thus, when these institutions cease to be Edison customers, they will not leave underutilized equipment that would have to be paid for by other customers. In fact, if Boston Edison were to serve the MASCO members, Edison has indicated that it would have to enlarge its distribution system. This would mean a capital investment of about $7,500,000 to construct a step-down transformer station on Colburn Street. In addition, monies would be needed to pay for debt servicing, maintenance of the facility, taxes and insurance. These costs would be avoided if the total energy plant is constructed.

It is therefore believed that loss of consumption of the MASCO members being supplied by the total energy plant would have no effect on Boston Edison rates because of growth of consumption, and because there will be no increase in the utility rate base for underutilized or new equipment.

Tax Revenues

The 121A corporation that will own the project will be exempt from paying property tax to the City of Boston. However, the 121A corporation has been discussing with the City payments to be made in lieu of taxes. The sum is still being considered but will probably be above the $59,403 currently generated in property taxes.

TABLE 5.2.8-1

PAGE 25 OF BOSTON EDISON'S ANNUAL REPORT

Record of Progress

Years ended December 31	1974	1973	1972	1971	1970
Peak Capability — KW (in thousands):					
New-Boston Station	760	760	760	760	760
Pilgrim Station	670	670	664	—	—
Mystic Station	633	633	633	633	633
Edgar Station	294	291	294	294	386
L Street Station	46	46	136	136	136
Gas Turbines	232	232	225	225	165
Contract Purchases from Canal Elec. Co.	143	143	143	143	140
Other Contracts	176	114	117	121	108
Total	2,954	2,889	2,972	2,312	2,328
Edison Territory Hourly Peak — KW (in thousands)	1,891	2,030	1,912	1,877	1,744
Edison Territory Load Factor	59.7%	59.0%	62.6%	59.9%	60.9%
Generating Station Economy — BTU per Net KWH Generated	10,363	10,309	10,472	10,602	10,707
Average Cost of Fossil Fuel — Cents per Million BTU	196.15¢	80.50¢	65.09¢	62.55¢	36.21¢
Electric Plant in Service per Edison Territory Hourly Peak — KW	$587	$532	$537	$394	$406
Electric Energy:					
Net system output (in thousands):					
Kilowatthours generated	9,316,510	12,373,004	9,589,014	8,749,630	9,233,453
Kilowatthours purchased	1,853,575	(203,292)	1,318,987	1,871,845	1,385,034
Total	11,170,085	12,169,712	10,908,001	10,621,475	10,618,487
Miscellaneous usage:					
Company	13,880	19,570	20,551	17,377	19,616
Transmission	350,535	345,158	354,538	292,984	264,047
Distribution	463,560	453,359	445,848	433,874	436,244
Other	44,349	48,679	181,353(a)	25,357	29,557
Kilowatthours sold	10,297,761	11,302,946	9,905,711	9,851,883	9,869,023
Kilowatthours Sold (in thousands):					
Commercial	3,691,526	3,755,949	3,345,906	3,136,030	2,894,417
Residential	2,404,665	2,524,436	2,389,512	2,278,194	2,149,165
Industrial	1,778,969	2,051,011	1,960,556	1,884,470	1,832,532
Street Lighting	100,074	97,743	91,102	86,625	84,275
Other Utilities:					
Purchasing total requirements	1,053,168	1,205,250	1,733,100	1,697,402	1,591,664
Edison Territory Total	9,028,402	9,634,389	9,520,176	9,082,721	8,552,053
Purchasing partial requirements	1,269,359	1,668,557	385,535	769,162	1,316,970
Total — Edison System	10,297,761	11,302,946	9,905,711	9,851,883	9,869,023
Kilowatthours Sold — Annual Growth Percent:					
Commercial	(1.7)	12.3	6.7	8.3	9.5
Residential	(4.7)	5.7	4.9	6.0	8.5
Industrial	(13.3)	4.6	4.0	2.8	1.4
Street Lighting	2.4	7.3	5.2	2.8	2.5
Other Utilities:					
Purchasing total requirements	(12.6)	(30.5)	2.1	6.6	9.9
Edison Territory Total	(6.3)	1.2	4.8	6.2	7.4
Purchasing partial requirements	(23.9)	332.8	(49.9)	(41.6)	(2.3)
Total — Edison System	(8.9)	14.1	0.5	(0.2)	6.0
Sales Statistics:					
Residential Averages:					
Annual Kwh Use	5,024	5,318	5,105	4,954	4,662
Revenue per Kwh	5.06¢	3.57¢	3.47¢	3.45¢	3.20¢
Annual Bill	$253.96	$190.01	$177.08	$170.67	$149.42
Customer:					
Meters at Year-End	593,752	592,415	587,420	585,129	585,160
Average Number	541,126	537,270	530,753	522,534	523,485
Number of Employees at Year-End	4,042	4,183	4,217	4,219	4,294

(a) Includes 124,365 Mwh of pre-commercial sales from Pilgrim Station Unit #1.

Employment

The project will not have a noticeable effect on employment of the area. Total employment will be 18 working over three shifts. These positions will be filled by skilled personnel, some probably from the existing powerhouse. Jobs currently in the Faxon building will be relocated within the medical area. The MASCO offices will not be a significant source of jobs although some new positions will be created.

5.2.9 Land Use

Impact on Land Uses

The allocation of the site for energy generation will preclude its use for residential purposes. This impact is not considered significant because of the units to be added in the Mission Park Housing Projects and the refurbishing of the multifamily homes between Francis Street, Fenwood Road, Vining Street and Huntington Avenue.

The Frederika Home, the residential dwellings along the south side of Francis Street and the Redstone building on the corner of Peabody Street and Brookline Avenue will not be adversely affected by the project.

The Frederika Home will actually experience an improvement in its environment because noise levels in its area will be reduced by replacement of the existing power plant with the proposed project and the roadway and parked cars of Peabody Street will be eliminated. This will create a more secluded backyard than presently exists. The facade that faces the Frederika Home will be architecturally treated and landscaped to create a pleasing appearance. Truck traffic along Binney Street beside the Home will not be significantly affected since this street is now used by fuel trucks that service the existing power plant and some trash trucks leaving the area. Oil trucks will increase in number to up to 18 per day and trash trucks will be reduced to one a week.

The residential area along Francis Street and Fenwood Road from Brookline Avenue to Vining Street will experience only a short term impact since plans made by MASCO in accordance with the community group Roxbury Tenants of Harvard call for replacing the dwellings with a

service center. This work would not begin until the Mission Park Housing Development is complete and the residents have been relocated. Therefore, present residents would not be subjected to any direct impacts of the project.

The adjacent Redstone Laboratory will be generally unaffected by the proposed project due to the nature of the activities taking place within the building and the fact that the Peabody Street side of this building has no windows overlooking the project site. As a result, the Redstone Laboratory tends to be insulated from the proposed energy plant.

Children's Hospital and its adjacent parking lot is currently located east of the site. The proposed project will have no land use impacts upon these facilities because it is planned that the Affiliated Hospital Center will be located on that site. These plans are being coordinated with those of the energy plant to ensure compatibility.

The commercial establishments west of Brookline Avenue should not be affected by the energy plant since they are generally oriented toward highway generated trade and convenience shopping. The proposed project will not hamper such sources of business activity.

The energy plant will benefit both the participating institutions and the Mission Park Housing Development by supplying utilities at lower costs and by providing an improved method of handling trash.

Consistency with Official Plans

Three documents were reviewed in evaluating the compatibility between the proposed project and official plans and ordinances. These include:

- The 1965-1975 General Plan for the City of Boston and the Regional Core,
- The Proposed Land Use Plan for the 1965 Fenway Urban Renewal Program, and
- The Boston Zoning Code and Enabling Act, as amended through November 30, 1973.

The 1965-1975 General Plan for the City of Boston and the Regional Core is the most current comprehensive plan available for the City of Boston. The Boston Redevelopment Authority is now in the process of updating and revising this plan. Because of the conceptual nature of the plan and the scale of its proposed land use map, it is neither feasible nor appropriate to ascribe exact boundaries to the planned land uses. Nevertheless, the plan indicates that with the exception of the frontage along Brookline Avenue, the proposed project site is classified as institutional. The strip along Brookline Avenue is slated for commercial use. Based upon this general understanding of the 1965-1975 General Plan, the proposed energy plant is consistent with this plan. Furthermore, the project-related MASCO office space along Brookline Avenue is compatible with the proposed commercial designation.

The Proposed Land Use Plan for the 1965 Fenway Urban Renewal Program indicates the same land uses for the site as does the 1965-1975 General Plan for the City of Boston and the Regional Core. Thus, the proposed project is also consistent with this plan.

The City of Boston Zoning Code indicates that the proposed site is within two zoning districts: residential apartment district H-3 and local business district L-1. There are no specific regulations which exclude or permit an energy plant from the site. The zoning code does indicate, however, that the proposed project may be conditionally justified as an ancillary use to the main operations of the member institutions involved. A definite clarification of this point depends on a legal interpretation of the code. In any event, an application will be submitted to the Boston Redevelopment Authority for development of the site through a corporation formed under Chapter 121A of the General Laws of the State of Massachusetts. Under Section 13 of Chapter 652 of the Acts of 1960, as amended, the Boston Redevelopment Authority, with the approval of the Mayor, has the exclusive power to grant permissions for a Chapter 121A project in the City of Boston to deviate from any applicable zoning, health, building and safety laws codes or regulations of its finds that such permissions would not substantially derogate from their intent and purpose. Such permissions will be sought for the total energy plant to the extent necessary to construct and operate it as designed.

Implications for the Future Growth of the Medical Area

The Medical Area witnessed rapid growth during the 1950's and 1960's. Since 1970, institutional development has continued, though at a less rapid rate. This latter trend is expected to continue into the future. Within this context, and the proposed energy plant cannot be viewed as a primary catalyst for the future growth of the Medical Area, for institutional expansion is imminent regardless of the proposed project. The energy plant will, however, facilitate future institutional development efforts by providing a source for utilities.

The project will not interfere with future construction on adjacent sites although a high rise building on the block north of the site would have to be designed to attenuate the higher sound levels that will occur above the cooling tower. The plant has been designed with consideration of the proposed Affiliated Hospitals Center.

Community Facilities and Services

Police and Fire Protection

The project will not interfere with or place a burden on area police and fire protection efforts for it will not place any demand on these services. During operation no special police protection of the plant or traffic control of the oil trucks will be necessary.

Storage of No. 6 oil on the site will not produce any fire hazard since it is not combustible except under controlled mechanical conditions of heat, pressure and constant flame. Subsequently, it is virtually a non-statistic as a fire risk. While the 25,000 gallon storage of No. 2 oil and 25,000 gallons of lube oil are more flammable, their storage tanks will be located within a vault which would contain a fire in the unlikely event that one should occur.

Combustion controls automatically shut off the oil flow to the boilers if the boiler flame should go out. This prevents a build-up of fuel that could damage the boiler if it should ignite. There are also steam relief valves which will quickly vent the steam from the system if too great a pressure builds up.

Medical Facilities

Operation of the project will not interfere with medical facilities in the area. The only external factor that may potentially interfere with medical activities would be from project associated truck movements, which may be considered an annoyance. While this project increases the annual number of oil delivery trucks from about 1800 to about 3600, it reduces trash trucks from 5200 to about 52 for an overall reduction in truck traffic of about 1,600 trucks per year. Truck movements will not block access to any facility. This project benefits the Medical Area by eliminating the present method of trash removal. The health care programs now on the site will be relocated within the Medical Area.

Educational Facilities, Open Space, Recreation and Neighborhood Services

Operational activities, other than trucks are confined to the site and therefore have no effect on schools, play areas, open spaces or recreation. There are no neighborhood services in the project area to experience any impacts.

Area Utilities

Since the project will make the hospitals independent of public utilities, customers of the public utilities will not experience voltage drops or blackouts that could be necessary to maintain the operation of the hospitals during times of peak system demand.

Because there are major water and sewer lines in the area it is not expected that water use and discharge will affect the area. Pressure tests will be taken by the City of Boston in the area to determine if a pressure drop will occur when the plant's water demand is high. It should be noted that this plant is a replacement and enlargement of the existing powerhouse and thus does not create a totally new load for the water supply and discharge system.

No storm water backup is expected since the runoff from the site will only be about 2.57 cfs during the ten year design storm and this is not significantly different from what now exists on the site.

Solid Waste Disposal

The solid waste generated by refuse incineration and particulate collection will be disposed of off-site at a sanitary landfill. Although this project is located within the City of Boston, this debris will not go to the Boston landfill because this facility is already operating at capacity. Two possible disposal locations are the Lynn Marsh Dump and a landfill operation in Amesbury. It should be noted that the incineration process incorporated into the project will reduce the total amount of solid waste to be dumped by 80%.

Radio and Television Reception

Operation of the electrical components of the energy plant will not create any radio or television interference. This is because the generators are solid state exciters that operate at 60 hertz and 4,160 volts and do not produce any electromagnetic waves of the same frequency as radio waves. Therefore, the generators cannot create interference.

Furthermore, the electrical generation and distribution system is completely isolated from Boston Edison so no impulses from the power plant could affect the line voltages that feed their individual customers.

Visual, Historic, Archeologic and Scenic Significance

Several long term visual impacts are expected to be associated with the operational phase of the project. The Faxon building will be demolished and thus this architecturally attractive feature will no longer exist as a structure in this area. Also, views of the area will be altered due to the introduction of the new structure. The stack (300 feet) and the cooling tower (90 feet) portion of the plant will be particularly obvious due to their heights. Although the stack is expected to be the tallest feature in the area, strobe lights or special markings are not required on it. Similarly, no visible smoke plume is expected to occur. Other tall structures in the area will be the dominant visual features. It will, however, be visible from many areas especially from elevated areas such as Parker Hill.

Persons who will have the most direct views of the plant itself will be those living in the Frederika Home and along Francis Street. The persons in the Frederika Home will have views of the plant which will include a pedestrian arcade and landscaping and a truck entranceway while persons on Francis Street will experience views of the plant similar to that included in the elevation drawing. The view from Francis Street will be short term due to the future plans for that block.

Shadows from the main building have not been fully evaluated because it was felt that they will not be greatly different from those which now exist since its height is comparable to existing buildings. Shadows cast by the stack would be narrow and therefore not significantly affect persons' views of the area. No person will experience shadows cast by the stack for long periods of time. The cooling tower shadow will fall mainly on the roof of the Redstone Laboratory and adjacent parking lot. Shadows will reach the Frederika Home at sunset during summer months and after 4:00 o'clock in the fall and winter months. Areas south of the site will not experience any shadows from the plant. The distribution tunnel will be underground and therefore completely hidden from view.

During the operational phase of the project oil delivery and ash removal trucks will enter the facility on Binney Street and exit on Francis Street. The actual pickup and delivery operations will occur totally within the structure and will not be visible.

The long term visual impacts of the project on the Olmsted Park System are expected to be limited. Specifically, future views by persons using the park might include occasional glimpses of the upper portions of the cooling tower and most of the tall stack. Similar views will be experienced by persons within the general vicinity of the site. Views of the stack will be possible from along some of the roads on the north side of Parker Hill, a high point in the larger area. Other such long views are not expected to be significantly altered by the introduction of the tall stack due to factors such as distance, screening by and relationship to other structures, and the diameter of the stack itself. The view of the plant from Brookline Avenue will be of a modern office building in keeping with the institutional character north of the site.

Transportation

The transportation impacts related to the operation of the proposed power plant will be due to: 1) the closing of Peabody Street, 2) the increase in fuel delivery trucks, and 3) the decrease of solid waste truck movements in the medical area. The closing of Peabody Street will be of minor impact. Its use as a local connector between Binney Street and Brookline Avenue is minimal with a peak hour volume of only 60 vehicles. Abutting properties across Peabody Street from the project should benefit from the closing of the street even though approximately 30 curb parking spaces will be eliminated. Peabody Street will be replaced with a quieter, more aesthetically pleasing pedestrian passageway. The closing of Peabody Street will reduce friction and turning movements at the current intersection with Brookline Avenue but will not significantly affect the existing levels of congestion and delay along Brookline Avenue.

The major transportation impact due to the operation of the proposed power plant will be the increase in the number of fuel deliveries to the medical area. Deliveries of fuel will increase from an average of 150 trucks per month for the existing power plant to approximately 290 trucks per month for the new facility. This is an average value; seasonal variations will require about 380 trucks in January but only 230 in August.

The fuel delivery trucks will come down Brookline Avenue from Kenmore Square to Longwood Avenue where they will turn left. This is a restricted turn and is not permitted between 4 and 6 PM and no deliveries will be scheduled during this period. Trucks will proceed along Longwood Avenue turning right onto Binney Street. The White Fuel Company has indicated that 6000 gallon trucks can make these turns with no difficulty. The trucks will drive into the unloading area of the site, which is parallel to Binney Street, by means of a curb-cut of Binney Street at the present intersection of Peabody Street. Arrangements are being made with the Frederika Home for permission to use the corner of their property. Trucks will leave the power plant by turning onto Francis Street. Curb parking will be restricted as necessary and the exit portal will be designed to permit a right turn onto Francis

Street without having the trucks cross into the far traffic lane. The design of the exit will prohibit left turns onto Francis Street. Deliveries can be scheduled to avoid periods when traffic demand exceeds capacity, and this will minimize any traffic impacts.

Because this total energy plant will include solid waste incinerators, the average of 300 trucks per month for fuel deliveries will be offset by a reduction of truck visits for trash collection. MASCO estimates that there are currently about 430 trucks per month making pick-ups in the medical area. Each truck entering this medical area now makes stops to collect trash at several locations throughout the area. The ash associated with the operation of the incinerators and dust collectors will be stored in a 30 cubic yard roll-off container which will require removal approximately once a week. Thus there will be a net reduction of truck traffic in the medical area of about 130 per month.

6. ALL MEASURES BEING USED TO MINIMIZE ENVIRONMENTAL DAMAGE

This section summarizes the environmental controls and efforts that will be taken to minimize environmental damage.

6.1 Design of the Proposed Plant

The advantage to the environment of the proposed project is that it consolidates and makes utility related activities in the area more efficient. Heat recovery from the combustion processes minimizes the amount of fuel required with a subsequent reduction of emissions of contaminants. This saving of fuel is especially desirable in these times of energy conservation. The motor driven chillers and back pressure turbine also serve to conserve fuel by making use of the efficient electricity generation and available steam supply. The proximity of the plant to the users allows return of condensate which lowers water requirements and distribution losses.

The transfer of solid waste to the facility by pneumatic tube and its subsequent incineration eliminates the current impacts of solid waste storage and removal from the area in trash trucks. Because of the heat recovery features of the plant even this incineration aids in the conservation of fuel.

The storage tanks for the No. 6 fuel oil will be made of concrete and compartmented to prevent release of oil. High and low level alarms on the tank, an enclosed oil unloading area, valves kept closed and oil and gas traps on the drains will prevent any oil from escaping during fuel deliveries. The No. 2 fuel oil and lube oil will be stored in fiberglass tanks within a concrete vault to prevent and contain any oil spills.

A counterflow cooling tower will be used instead of the crossflow type on the existing plant. The proposed tower is inherently quieter since fill material is enclosed thereby reducing water noises. Most of the air to the tower will first pass through the plant to reduce intake noise and air to the diesels will take a circuitous path to prevent release of noise. Brick and concrete walls of the building will prevent

noise transmission of the operating equipment. An enclosure will be placed around the diesel area to lower interior noise levels which will also reduce transmission of noise to the environment. The enclosed unloading area will contain any truck noises during ash removal and fuel unloading.

The special design of having the diesel engine jacket water pass through coils in the upper portion of the cooling tower will prevent the formation of a visible vapor plume. This eliminates the potential for icing and fogging conditions as well as reducing the undesireable aesthetic impact of a visible vapor plume.

The stack height will be high enough to allow only small contributions of contaminants to ground level concentrations and avoid the wind effects of existing and proposed buildings. The 300-foot stack has been selected as appropriate from an air pollution viewpoint without being unduly high to create an adverse aesthetic impact.

Multitube cyclone collectors will be installed after the steam boilers and incinerators to control the particulate emissions. It is expected that because of these collectors and the low ash content of oil being used in the Boston area that particulate emissions will be low. An opacity meter will be installed in the stack to measure the plume visibility and will serve as a check on the performance of the combustion process. Oxygen analyzers will be placed in the combustion air to the boilers to control the amount of ambient air admitted to supply the correct concentrations of oxygen for combustion. Sulfur dioxide emissions will be controlled by limiting the sulfur content of the oil burned to the allowable level of 0.5%. The smoke stack will be insulated to minimize the temperature change of the flue gases as they flow upwards. This will help maintain good plume rise and prevent the condensation of SO_3 and the formation of acid smut.

The energy plant building architecture will be in keeping with the institutional buildings that are in the area. The pedestrian arcade will facilitate movements between Brookline Avenue and Binney Street and create a pleasing view from the Frederika Home. Creation of the new office space along Brookline Avenue will present a business-like appearance to people travelling along this roadway. Lighting will remove dark areas about the plant and the stack will not have strobe lights or special markings.

Placement of the unloading area along Binney Street will allow a passage for trucks through the area, backing and turning will not be necessary. Because the project removes the need for many trash trucks through the area, there will be an average net reduction of truck traffic of 130 trucks per month.

6.2 Construction Techniques

The following list shows those activities which will reduce construction impact.

- Demolition will be from the interior of the site to allow the standing structures to shield the activities from the adjacent residential area.
- Spraying the demolition area with water will reduce fugitive dust.
- All loads leaving the site will be covered and the trucks will have mud flaps also to control dust.
- Material from demolition will go to an approved landfill.
- After demolition is complete, a fence will be erected around the site to provide security.
- No trucks will be loaded beyond allowable limits and all vehicles will have mufflers to reduce sound levels.
- Excavation will proceed from within the site so that the earth movers will be below grade as the work progresses.
- Trucks being loaded will drive into the excavation area and avoid being loaded on the surrounding streets.
- Excavated material will probably be taken to other projects for backfill.
- Trucks leaving the site will be sprayed when necessary to keep dirt from being deposited on city streets.

- As excavation proceeds, sheet piling may need to be driven along Binney and Francis Streets. This pile driving will only be done during the day. Piles along the other sides will be placed in preaugered holes before being driven, if they are required to hold the slopes.
- The depth of excavation will be above the water table so no dewatering of ground water will be necessary.
- Entrance to the site will be on a graveled surface to control dust.
- Foundations of the building will be on spread footings which excludes pile driving for foundational support.
- Concrete trucks will drive onto the site for delivery instead of requiring pumping or buckets.
- Activities will be planned so that trucks waiting to unload will be minimized.
- Work will be conducted only during weekdays.
- The site will be lighted and patrolled at night.
- Construction of the distribution tunnel will be away from the residential areas and will proceed in sections to minimize disturbances.
- Only infrequent short-term interruptions of utilities are expected.

6.3 Operation

The following list are those operational characteristics which will reduce operational impacts.

- The plant will be carefully controlled to ensure maximum operating efficiency which will minimize emission levels.
- Start-up and shut-down of combustion equipment will be with No. 2 fuel oil which will reduce particulates and SO_2 emissions during these times.

- Soot blowing, if found to be necessary, will be done frequently enough to avoid ash being built up before being blown off the heating surfaces into the collectors.
- Incineration will be done on a batch basis to ensure complete combustion. Fresh material will only be added when the previous batch has been completely incinerated.
- Multitube cyclone collectors will follow the incinerators to remove particulates from the flue gas before they enter the boilers. Any odors that may form during incineration will be eliminated in the steam boilers.
- Air from the pneumatic tube delivery system will be used as combustion air to the incinerators and thus prevent odors from escaping.
- Oil delivery and ash removal trucks will be scheduled to minimize disturbance to area residents. At this time it is planned that deliveries will be made during off-peak traffic times during the day; however, this can be changed if it is found that night deliveries would be better from an environmental view.
- Oil trucks leaving the site and passing the residential area will be empty which will reduce noise impact. Since the residential area is planned for institutional use, any impacts to residents during operation will be short term.
- All loading and unloading activities will be conducted within the plant.

6.4 Actions Taken by Governmental Bodies or Private Groups that Will Influence the Environmental Impact

There are a number of current and proposed developments within the project area which are discussed in Section 4.8 of this report. The projects that would have the most influence on this project are the Mission Park Housing Development and the Affiliated Hospitals Center. Since both projects would be in construction concurrent with the

proposed project, they will greatly influence the impacts during the construction phase. At that time, loss of about 1,600 parking spaces and lack of parking for all construction workers for the projects will aggravate the existing parking problem. They will also increase the number of trucks, traffic congestion, and noise in the area. The other projects in the area will further add to construction impacts such as fugitive dust and aesthetics during this phase of their development. It is not expected that the total energy plant by itself will interfere with the development or operation of any facility or community activity in the area.

The planned dredging of Muddy River by the MDPW will not be affected by the energy plant since the surface runoff from the site now or in the future is not a significant increase to the flow of the river.

Diversion of water into the Quabbin Reservoir will increase the safe yield of the MDC water system. This will not significantly influence the project or the project's effect on water quality. It is expected that the concentration of solids in the water going to the plant and then being discharged will be higher than before the diversion. Since the diversion water will only be about 10% of the water in the Quabbin Reservoir the impact should be insignificant.

6.5 Unavoidable Adverse Impacts

It is impossible to construct and operate a total energy plant or any project without interacting with and, therefore, modifying the surrounding environment to some degree. However, the alteration of the environment does not necessarily imply that these are adverse impacts. The proposed project has been designed to comply with applicable federal, state and city regulations and to minimize environmental effects. The emission of air contaminants, consumption of fuel, need for oil delivery and ash removal trucks, use and discharge of water, use of the site for an institutional use and the appearance of the building are unavoidable results of this project but are not considered to be adverse.

Air contaminant emissions will comply with federal and state regulations and will contribute only a small amount to ground level concentrations. The termination of emissions from the existing power plant

and the increased emissions of SO_2 and particulates if the utilities were to be produced by other means will offset the impact of the project to some degree. The increase in NO_x emissions is an unavoidable impact.

While this project will consume approximately 21,453,000 gallons of fuel oil per year, total consumption would be higher by about 6,150,000 gallons per year if chilled water and steam were made and electricity purchased.

Oil delivery and ash removal trucks will visit the site but the overall number of trash trucks traveling through the area will be reduced by 130 trucks per month. Oil trucks traveling to and leaving the site will be about twice the existing number. They will, however, be a small addition to existing traffic.

Water use and discharge will be approved by the City of Boston to ensure its compatability with existing capacities of supply lines and services.

Use of the site for energy generation instead of housing has not been considered adverse since housing will be available in the area when the housing project is developed and medical services are already available in the area. The displacement of urban wildlife and vegetation should not be significant since there are no rare or endangered species. No historical structures or archeological sites will be disturbed by the project. The aesthetics of the project will affect the area but this will be similar to impacts of the existing institutional buildings in the area. Parking will not be adversely affected since the demand created by the project will be small and will be offset by changing employment from the existing plant. Major truck deliveries will avoid peak periods of traffic congestion so as not to create traffic problems.

Noise created by operation of the project is also unavoidable but because of the design of the plant it will be quieter than the existing plant and ambient sound levels will decrease after replacement of the existing plant.

Noise during construction of the project will be an unavoidable adverse impact especially during any period of pile driving. The pile driving phase that will produce the most disturbance will occur for only about a one-month period. Noise during the other construction phases will be due mainly to trucks entering and leaving the site which can

produce interior noise levels of adjacent buildings of from 64 to 70 dBA.

6.6 Alternative Measures that Could Further Reduce Environmental Impact

The design alternatives that have been available to the planners have been carefully considered to ensure a project that is environmentally sound. These alternatives are discussed in Section 7 of this report.

There are other measures that can be taken by the planners and by city regulatory agencies that can further reduce environmental impacts of parking and traffic congestion. These include re-examination of the sequence of traffic lights along Brookline Avenue to avoid traffic build-up and the use of signal lights for turns. Reports of traffic conditions expected during days of high use could be published to warn motorists to take other routes.

The parking problem that will occur during the period of construction in the area will be alleviated by the establishment of remote parking areas served by shuttle buses to the area for both construction workers and employees. Other means of reducing parking problems are as follows:

1) limiting parking in the area to residents which would force commuters to park further from the area and take public transportation

2) increase the frequency of public transportation to make it more convenient

3) paying bonuses to construction workers that use public transportation or form car pools

4) strict enforcement of parking regulations that currently exist to prevent practices of double parking

5) creation of parking areas for bicycles and motorcycles to promote the use of these smaller vehicles.

Traffic circulation and parking for the medical area and roadway changes from the three major projects in the area, the total energy plant, Affiliated Hospitals Center and Mission Park Housing Project, are currently under study.

The preliminary findings of this study are contained in the February 28, 1975 Draft Copy of the report entitled Transportation Planning for the Medical Area, prepared by Charles G. Hilgenhurst and Associates and Wilbur Smith Associates. The following section is quoted from that Draft report; it should be stressed that these represent draft recommendations that are currently undergoing agency and community review:

Short Range

1. Improve pedestrian safety and security from the Medical Area to Longwood Station of the MBTA Riverside Green Line;
2. Help establish and market MBTA crosstown bus service from Cambridge to Roxbury via the Medical Area;
3. Institute a Parking Management Plan whereby employee parkers are assigned off-street spaces on the basis of their travel direction, not Medical Area destination. As part of this plan, restrict through travel on Blackfan Street and Binney Street during the employee peak arrival and departure periods; and
4. Coordinate local street improvements with facility construction projects;

    - Test Riverway/Brookline Avenue one-way pair scheme. Maintain one "contra-flow" lane on Brookline Avenue for trucks, buses, emergency vehicle, and local auto-use;
    - Implement either planned Metropolitan District Commission improvement of Riverway/Brookline Avenue intersection, or test a reversible lane arrangement to accommodate imbalanced flow along Brookline Avenue;

- Provide a new connection from Riverway northbound to Park Drive northbound that precludes the need to cross Brookline Avenue twice;
- Widen Francis Street from Binney Street to Brookline Avenue; and
- Provide a bikelane on Longwood Avenue between Riverway and Brookline Avenue.

Long Range

1. Provide high quality convenient shuttle service to the Roxbury Crossing Station of the relocated MBTA Orange Line;
2. Extension of Blackfan Street north to Avenue Louis Pasteur and access to Park Drive from Avenue Louis Pasteur should have high priority. Implementation of this access improvement will enable full use of the Parking Management Plan;
3. Improve central circulation system to relieve congested intersection and provide circulation for planned facilities:
   - Extend Shattuck Street to Binney Street;
   - Extend Binney Street to Fenwood Road;
   - Close Vining Street between Francis Street and Fenwood Road;
   - Extend Shattuck Street to Francis Street near Saint Albans Road; and
   - Widen Francis Street to 44 feet between Brigham Circle and Saint Albans Road; and
4. Review with City and community officials grade separation schemes that would improve pedestrian safety and vehicular capacity at several major intersections;
   - Longwood Avenue and Brookline Avenue;
   - Riverway and Longwood Avenue;

- Brookline Avenue and Riverway; and
- Brigham Circle.

To ensure these transportation improvements keep pace with Medical Area growth, transportation planning should be a central part of the continuing communicative process between;

- MASCO;
- Medical Area institutions;
- Neighboring communities;
- City agencies; and
- Interested or affected recognized Ad Hoc groups.

7. ALTERNATIVES TO THE PROPOSED PROJECT AND THEIR PROBABLE IMPACT ON THE ENVIRONMENT

This section describes the alternatives considered in the decision to build the total energy plant and their major environmental impacts. The rational used in rejecting the alternatives is also presented.

7.1 Taking No Action

A program of necessary expansion, modernization and consolidation has been taking place within the medical area of Boston resulting in advanced research, educational and patient care facilities. Current and proposed developments in the area are discussed in Section 4.8 of this report.

MASCO and its enginerring consultants have estimated that the peak utility needs of the member institutions by 1978 will be as follows:

steam	559,000 lbs/hr
electricity	26,000 Kw (diversified)
chilled water	15,000 tons

These estimates are based on floor areas, heating and cooling degree days and present and projected needs of the individual institutions. Some of the present utility needs are supplied by the powerhouse at 17 Blackfan Street which has the following current capacities:

steam	385,000 lb/hr (firm capacity)
electric	2,000 Kw (installed capacity)
chilled water	4,400 tons (installed capacity)

A new 1,900 ton chilled water generator is being added to the existing powerhouse to meet current needs.

The existing powerhouse will not be able to meet the steam and chilled water demands of the institutions by 1978. Accordingly, new supplies of utilities must be established, and it is planned that the existing powerhouse will be razed when the proposed facility begins operation.

Environmental impacts of this alternative have not been considered in detail since this is not a feasible alternative.

If no action is taken, the existing sources of environmental impact will not change, but as the medical area becomes further developed, the environmental impacts might become more significant. For example, as discussed in Section 4.5 of this report, the existing cooling towers are a dominant source of noise in the area. The addition of new buildings adds sensitive receptors to the area which could experience disturbance from this source.

Taking no action leaves the solid waste situation as it is. Noise from trucks, health effects due to litter and attraction of vermin could be eliminated by the incineration service within the proposed facility.

Even though air contaminant emissions are in compliance with state emission standards for existing sources, the presence of buildings taller than the stacks could cause reception of higher ambient concentrations of contaminants. The new facility would be designed with this interactive effect in mind.

Benefits of this alternative would include avoiding any construction impacts and different use of the proposed site. However, it is likely that the block containing the proposed site would still be developed in the near future for some institutional or office use and therefore taking no action has no real benefits.

This alternative was eliminated because of infeasibility and benefits of discontinuing impacts of the existing power plant.

7.2 Deferring the Action

This alternative involves building the project as proposed, but at a future time. The purpose of this would be to stagger construction projects in the area to avoid cumulative effects such as parking and traffic congestion. It would also allow time for residents facing the site along Francis Street to be relocated to the Mission Park Housing Project before construction would begin on the proposed site.

The difficulty of this is that the energy needs of the institutions must be met by 1978, when hot water will have to be supplied to the Mission Park Housing Development. Furthermore, Boston Edison does not currently have the transmission capacity to supply the institutions with the increase in electricity needed by 1978.

In order to serve the institutions, Boston Edison would have to construct a step-down transformer station on its Colburn Street site shown in Figure 7.2-1. Communications between MASCO member institutions and Boston Edison have indicated that this situation occurs because there is not enough distribution capacity to get the high voltage electricity from step-down station #329 in Brighton to the medical area. Transmission Line Group #1 and Line Group #2 serve the medical area institution in addition to other customers.

Edison expects that Line Group #1 will be overloaded by 500 KVA in the summer of 1976 and by 1,000 KVA in the summer of 1977; Line Group #2 will be overloaded by 3,500 KVA in 1976 and by 4,000 KVA in 1977. This will require the institutions to follow shedding programs.

According to Boston Edison, the situation becomes more acute in the summer of 1978. At that time, not only will the cables to the medical area from Brighton step-down station #329 be overloaded but the Brighton station itself will be overloaded by 22,000 KVA. That overload is almost the entire peak electrical demand of the medical area institutions.

Since the plans for the total energy plant have been proceeding, Boston Edison has decided not to build the transformer station because it would be left with an underutilized facility once the energy plant became operational. Because of these problems and the increasing demand for electricity, steam and chilled water, some action must be taken now to ensure that the hospitals will be able to operate at their planned levels.

7.3 Alternative Sources of Utilities

In considering the possibility of having the institutions become self-sufficient for utilities, two main questions were first addressed: reliability and availability of fuel.

Figure 7.2-1 Locations of Boston Edison Facilities Required if the Energy Plant is Not Built

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MASCO and its consultants determined that there is no basis for expecting on-site utility generators to be less reliable than the public utility system. In fact, there is reason to expect that the reverse will be true. On-site generation is becoming more and more common as a reliable means of meeting critical power needs. The IRS regional automatic data processing center in Brookhaven, Long Island, built in the late 1960's, includes its own 8500 KW on-site generating plant "to satisfy the need for power availability required by sophisticated computer equipment." Sears cited the same reason when choosing to generate all its own power at a new automated regional distribution center in Columbus, Ohio. Complex equipment could not be operated satisfactorily with the risk of outages and frequent voltage dips from the public utility system. New England Memorial Hospital in Stoneham, Massachusetts, has generated its own power for 15 years and its officials say they have consistently had a better record of availability and freedom from voltage dips than the public utility. Furthermore, the MASCO institutions have a long history of reliable production of their own utilities. In 70 years of operation, the present powerhouse has had only one unscheduled interruption in service and that lasted only an hour.

It was also determined that availability of fuel will not be a problem. During the height of the energy crisis last winter, while Boston Edison was discussing "rolling blackouts" and reducing voltage every afternoon, while the public utility steam system in Cambridge was placing a flat limit on the total amount of steam they would deliver to Harvard University, month-by-month, the Federal Energy Administration published regulations establishing that the MASCO institutions had the highest priority for available fuel oil, and were entitled to 100% of current requirements.

The following are alternatives to the proposed facility that were considered to meet the needs of the institutions.

Expanding and Modernizing the Existing Powerhouse

This alternative consists of replacing most of the equipment in the existing plant with larger capacity, modern steam producing equipment and water chilling equipment and installing electricity generators. Present design and lack of space makes this alternative impractical.

The existing powerhouse, placed in operation in 1904 has been expanded and modified to its present capacities. Since the plant has developed by "adding on", its configuration is not practical for equipment replacement. After the installation of the new chilled water unit, there will be no more room for additional equipment. For example, all steam produced goes into one steam header. Removing units would, therefore, require interruption of steam service while the steam lines are disconnected and sealed. There are no available sources of steam during these periods.

Enlarging the powerhouse building would also not be possible since adjacent open areas are used for truck movements or are owned by Boston Edison and are not available for plant expansion.

Environmental aspects of this alternative are not presented because of the unreality of the alternative.

Individual Production of Utilities and Services

Each institution could establish its own source of chilled water, steam and electricity. However, this would entail many small chilled water generating units, oversized to maintain individual reliability, placed throughout the medical area, and each installation would have its own cooling tower. Smaller institutions would also be forced to pay high capital costs of owning individual units.

Costs of the diversified equipment for steam and electricity sized for reliability, separate qualified operators, fuel storage, and controls would make this approach more expensive than a central plant.

Without the economics of operation in the proposed plant produced by interrelating the steam, electricity and chilled water generating equipment, the increased amount of fuel burned in the area would be approximately 6,150,000 gallons/year. Even higher fuel consumption is likely since separate equipment would not often be operating at its optimum condition due to continuously changing loads. At 33.3¢/gal of oil, this increased fuel would cost $2,047,950/year.

Each institution could also install its own refuse incineration. However, initial first costs plus ash storage and hauling and no recovery of the heat generated would make this more expensive than present

hauling charges. In fact, a central incineration facility of the size proposed is not economically practical without heat recovery as shown in Table 7.3-1.

Environmental Impacts of Individual Production of Utilities and Services

A full environmental analysis has not been conducted since design of the alternative has not been done. Therefore, impacts are given qualitatively and compared to the proposed project whenever possible.

Air Quality

Air quality impacts for this alternative would change from those of the proposed facility because of larger fuel consumption, different combustion equipment and multiple cooling towers.

If the combustion equipment were required to be in compliance with the Massachusetts emission standards that apply to the proposed plant, the change in air contaminant emissions will be as follows:

	Proposed	Individual Generating Units	Change In Emissions
SO_2	1,685,700 lb/yr	2,151,660 lb/yr	+465,960 lb/yr
Particulates	154,800 lb/yr*	199,000 lb/yr	+ 44,200 lb/yr
NO_X	3,525,110 lb/yr	1,194,950 lb/yr	- 2,330,300 lb/yr

* Does not include particulates associated with incineration.

The increases in sulfur dioxide and particulate emissions are due to increased use of oil while the decrease in NO_X emissions is due to possible use of other equipment than diesel generators. Each source would be designed so that ambient air quality standards would not be contravened.

The use of more cooling towers to remove heat from the water chilling equipment could create numerous visible vapor plumes and create a fogging problem since there would not be enough useable heat to eliminate visible vapor plumes. An analysis of frequency and length of plumes has not been conducted since potential locations of cooling towers and operation conditions at each location have not been identified.

TABLE 7.3-1

ECONOMICS OF CENTRALIZED INCINERATION

Total Investment for Pneumatic Collection System and Incineration Equipment	$2,343,500
Annual Debt Service	195,000
Present Contract Haulage Charges Avoided*	<200,000>
Projected Contract Haulage Costs:	
Ashes	25,000
Wastes Outside of the System	15,000
Operating Expenses and Maintenance	30,000
Additional Annual Cost of Incineration Compared to Present Cost of Removal	$ 65,000
Savings Due to Heat Recovered - Equivalent to 60 gal/oil/ton of refuse x 5,170 tons/year x 33.3 ¢/gal	$ 103,300
Savings per Year with Heat Recovery	$ 38,300

*Based on actual 1972 costs to member institutions.

Hydrology

There would be no significant effect since the individual units would probably not occupy open unpaved areas. Thus, runoff rates to the Muddy River would probably not be changed from that which now occurs.

Water Quality

Water consumption and discharge rates and chemical concentration will be approximately the same as those of the proposed facility and there should be no change in impact from operation. The additional oil trucks in the area would cause an increase of chemical quantities in the runoff of about 25% over those of the proposed plant.

Geology

The individual units would be built above the water table to help keep construction costs down and there should be no effect on geology or geohydrology of the area.

Noise

Noise impacts would be produced during construction as well as operation. Construction noise would probably have more of an impact for this alternative than the proposed project since the activities would occur at more points throughout the medical area and would probably be closer to sensitive receptors. Elimination of the proposed distribution tunnel would probably be more than offset by the increased amount of construction equipment for the individual installations.

Furthermore, the smaller multiple installations are more difficult to design and operate as quietly as the proposed installation. For example, in the smaller installation the proposed design of counterflow towers with higher noise levels might be required which could produce an adverse noise impact. Increased fuel use also requires more trucks moving through the area which could cause short-term annoyances.

Ecology

There should be no significant effect on area ecology because of the urban setting and absence of any rare or endangered species of plant or wildlife.

Social and Economic Characteristics

Using individual utility generating units would obviate the energy plant from the proposed site, keep an "industrial" activity from the neighborhood and allow other developments or residential uses to take place on the site. It is likely that the presence of numerous cooling towers and stacks could give the entire medical area the appearance of a factory.

The separate units would require more manpower for operation. However, since the jobs would be in specialized areas this is not considered a benefit to the area employment.

Land Use

This alternative could affect expansion of medical facilities by requiring them to allocate room for utility generation rather than health care. It would not have an adverse effect in development in the surrounding area since it would probably not affect access to residential, commercial, historical, archeological or scenic areas. Making the proposed site available for institutional, residential or commercial development would be a benefit.

Conclusion

This alternative was judged to be unsuitable for the area because of the increased costs of construction and operation and effects of multiple cooling towers, stacks, fuel delivery trucks and proximity of sensitive receptors. It also does not change the present method of handling refuse. It has been judged to be adviseable to centralize as many operations as possible for economy and to allow more complete environmental control.

Purchasing Electricity

This alternative consists of purchasing all the electrical needs from Boston Edison and still producing steam and chilled water and incineration. Modifications would include operating all the chilled water generators by steam turbines instead of using any electric motors in order to reduce the cost of electricity, elimination of the back pressure steam turbine driven generator, the diesel driven generators and heat recovery boilers. These changes would remove the savings of heat recovery and the efficient production of electricity of the back pressure turbine and diesels.

Removing the electricity generating equipment increases the overall costs of producing utilities by approximately $1,980,000 per year based on costs of purchasing electricity at current rates minus the costs avoided by not making electricity. Table 7.3-2 shows the basis for the increased cost based on estimates made by MASCO. It should be noted that the annual cost increase does not include any allowance for increased costs of electricity. Boston Edison's latest rate hike request which was to be effective December 1, 1974, would have further increased the overall cost of utilities to the institutions. It has been estimated by an official of the National Utilities Services that electric utility rates will increase at a rate of 15 to 25 percent for the next 5 years. At a 15 percent rate increase per year, the additional cost of providing the institutions utilities would be about $6,500,000/year in 5 years if the plant were designed with the intent to purchase electricity.

This alternative requires an overall increased use of fuel of about 6,150,000 gal/yr because of lack of heat recovery and lower efficiency of electrical generation.

In addition, in order to serve the institutions Boston Edison would have to construct a step-down transformer station on its Colburn Street site. As discussed in the previous section, Boston Edison has decided not to build this facility.

Environmental Impacts of Purchasing Electricity

These impacts are those associated with the modified project. No evaluation could be made of Boston Edison's required construction or impacts caused by the level of operation at their Colburn Street site if Boston Edison decided to build that facility now.

TABLE 7.3-2

CHANGE IN COSTS OF UTILITIES WHEN PURCHASING ELECTRICITY

Cost to Purchase Electricity at September 1, 1974, Rates:		
Demand Charge	$ 937,529	
Consumption	1,434,810	
Fuel Charge	3,886,017	
	$6,258,356	$6,258,356
Costs Avoided by Purchasing Electricity:		
Fuel Costs 6,150,000 gal/year at 33.3¢/gal.	-$2,050,000	
(This includes elimination of fuel for operating the diesels and back pressure turbine and increase of fuel for steam production to run the chillers and make up for heat lost by removal of heat recovery.)		
Ownership and Operating Costs	-$1,500,000	
(This includes change in annual debt service for different installed equipment, operating and maintenance costs and an allowance for contingencies.)		
Payments Made in Lieu of Taxes*	-$ 300,000	
	-$3,850,000	-$3,850,000
Reduction in Cost of Electricity if Pilgrim Power Station Operates at Full Load**	- 535,000	-$ 535,000
Net Change in Cost of Utilities if Electricity is Purchased		$1,976,644

NOTE: This does not include any allowance for further increases in future cost of electricity.

*This is only an estimate of payments that would not have to be made in lieu of taxes. This has not been established with the City of Boston.

**Estimate from Thomas Galligan, Jr., President of Boston Edison provided to MASCO.

Air Quality

The use of more fuel in the Boston area in different combustion equipment would change the quantity of air contaminant emissions. These are shown below:

		Change in Emissions	
SO_2	+	465,960 lb/yr	
Particulates	+	44,200 lb/yr	does not include incineration at the proposed facility
NO_x	-	2,330,300 lb/yr	

Emissions of SO_2 and particulates increase because of the increased fuel use and NO_x emissions decrease because the oil that would have been burned in diesels would be burned in steam boilers and gas turbines within the Boston Edison system. These emissions are based on all combustion equipment in the Boston Edison system complying with the same emission standards as the proposed facility. Since most of Boston Edison plants are existing their emissions are controlled by less stringent regulations, and their emissions could be higher.

The significance of these changes in emission can best be viewed in terms of the total emissions from the Boston Edison System. In 1973 the total electricity produced in the Boston Edison System was 12,373,004,000 kwhr. Based on oil with a heat content of 18,500 Btu/lb, a heat rate of 10,309 Btu/kwhr and the Massachusetts emission standards for the Boston area the allowable emissions in 1973 would have been as follows:

SO_2	2.22×10^8 lb/yr
Particulates	0.64×10^8 lb/yr
NO_x	3.83×10^8 lb/yr

The changes in emissions would therefore be an increase in SO_2 of 0.20%, particulates of .07% and a decrease in NO_2 of 0.6%.

Another major impact of this alternative is the removal of the source of heat that would eliminate the visible vapor plume from the cooling tower. This could cause fogging problems as well as an adverse visual effect.

Hydrology

This area of impact would be the same as for the proposed plant because the site would still be used for the steam and chilled water generation and incineration.

Water Quality

Water consumption and discharge at the proposed site could increase by about 50% for condensing the steam for the turbine driven chillers that would replace the motor driven units. Water quality of runoff from the site would improve due to a reduction of oil delivery trucks of about 25%.

Geology

This area of impact would be the same as for the proposed plant because the site would still be used for the steam and chilled water generation and incineration.

Noise

Noise impact of the facility could increase because of the 50% increase in cooling requirements. Redesign would be required to maintain the same levels as those of the proposed facility. The frequency of any noise disturbance from oil delivery trucks would be reduced by about 25% because of fewer fuel deliveries.

Ecology

This area of impact would be the same as for the proposed plant because the site would still be used for the steam and chilled water generation and incineration.

Social and Economic Characteristics

Due to lack of heat for plume abatement, the visible vapor plume from the cooling tower could cause an adverse visual effect. Other areas of this impact would be the same as for the proposed plant because the site would still be used for the remaining parts of the project. This project could still have a benefit to real estate taxes by payments in lieu of taxes; however, this has not been discussed with the City.

Land Use

Visible vapor from the cooling tower could affect the desirability of residential development in the area because of the industrial like appearance. There should be no other different effects than those of the proposed project.

Conclusion

This alternative was not selected because of Boston Edison's decision not to build the Colburn Street step-down transformer. This would necessitate an impractical amount of institutional reduction in electrical demand during periods of transmission line overload. Furthermore, even if the step-down station were to be built, the higher costs of utilities, increased oil consumption, effects of the cooling tower vapor plume and lack of significant benefits make this alternative unattractive.

Purchase Steam and Electricity

This alternative consists of buying electricity and steam from Boston Edison and constructing a central chilled water plant. This would cause elimination of the incinerator and fuel oil storage. It is possible that for this alternative the existing plant could be converted to a larger chilled water plant or the proposed site could be used. This alternative necessitates construction by Boston Edison of a new steam station at their Station Street site, a steam line to the chilled water plant and distribution system to the institutions, and the previously discussed step-down transformer station at their Colburn Street site. The location of these sites required for Boston Edison construction are shown in Figure 7.2-1.

The economics of this alternative determined by MASCO result in an increased annual cost of utilities to the institutions over the $1,980,000 cost if only electricity were purchased. This is due to the increased cost of purchasing steam in addition to the electricity. In evaluating costs, worst case assumptions were used to exaggerate the costs of the institutions making the utilities and low costs were used in estimating costs of purchasing steam and electricity.

Increase in area fuel consumption would be about 10,500,000 gal/yr because of lower efficiency of steam and electricity generation and necessity of all steam turbine operated water chillers instead of using the proposed motor driven chillers.

Environmental Impacts of Purchasing Steam and Electricity

These impacts are those associated with the chilled water plant at the proposed site or at the existing power plant site. No evaluation could be made of Boston Edison's required construction or impacts caused by their level of operation.

Air Quality

The overall change in contaminant emissions in the Boston area would be as follows:

SO_2	+ 819,000 lb/yr	Incineration would not be included in the remaining project
Particulates	+ 76,125 lb/yr	
NO_2	-1,135,254 lb/yr	

This is due to the increased fuel use and use of different combustion equipment. These emissions would not be totally removed from the medical area since some fuel would be burned at the Station Street steam station.

The impact of the cooling tower on the chilled water facility would be the same as for the previous alternative of purchasing only electricity. A visible vapor plume would occur since there would be no source of useable heat for plume abatement. Fogging and an adverse visual impact could occur at either the existing plant or proposed site.

Any impact on air pollution due to delivery of fuel to the proposed site would be eliminated since oil would not be required. There would, however, be no reduction in the trucks for refuse removal.

Hydrology

There would be no difference in impact from existing conditions if the chilled water facility were at the existing power plant site and the impact would be about the same as that of the proposed facility if it were at the proposed site.

Water Quality

This alternative increases water consumption because the condensed steam could not be returned to the steam station. This would be a loss of more than 200,000,000 gal/yr. It is expected that an equal amount of water would be required to dilute the condensate to reduce its temperature before it is discharged to the city sanitary or storm sewer. Cooling requirements for the chilled water generation could also increase by about 50% which increases water consumption and discharge quantities from the proposed plant by 50%. Water quality of runoff would be improved since there could be no truck traffic to either of the sites for fuel deliveries.

Geology

Construction of the chilled water facility at either location would have no impact on geology or heohydrology since it would be above the water table.

Noise

The increased capacity cooling tower at the existing plant site could adversely affect the adjacent sensitive receptors unless extra expense is incurred in installing a counterflow tower similar to that of the proposed project. Construction activities at that site for removing existing equipment and installing new equipment could cause a significant impact because of the proximity of adjacent hospitals.

The cooling tower at the proposed site would be further removed from sensitive receptors so the impact would be less. Construction activities would cause less impact than for the proposed facility since the extent of work would be less.

Ecology

The impact at either site would be insignificant due to the urban setting and absence of rare or endangered species of plants or wildlife.

Social and Economic Characteristics

Use of the existing plant site would preclude social and economic impacts of the chilled water facility since it would be removed from residential areas. At the proposed site the social impact would have

some impact because of the industrial-like appearance due to the cooling tower vapor plume. It would have more economic impact than the proposed facility since the payments made in lieu of taxes would probably be less.

Land Use

Use of either site would not affect land uses in the area since access to residential, commercial, historic, archeological and scenic areas would not be obstructed. The visible vapor plume could affect the desireability of residential development in the area because of the industrial-like appearance.

Conclusion

This alternative was not selected because of Boston Edison's decision not to build the Colburn Street step-down station. This would necessitate an impractical amount of institutional reduction in electrical demand during periods of transmission line overload. Even if Boston Edison's facility were to be built, the cost of electricity would be unattractive.

By becoming part of the Boston Edison steam system, the institutions cannot be assured that their needs will be met at all times. Fuel shortage, mechanical failure, and routine maintenance could cause the steam pressure to drop throughout major parts of the system which would affect the medical area. Furthermore, the increased costs of fuel and water consumption make this alternative unattractive.

Purchasing Electricity and Jointly Owning a Steam Station with Boston Edison

This alternative, proposed by Boston Edison to MASCO, is an attempt to reduce MASCO's cost of steam and ensure a set level of service. It is physically similar to the previous alternative of purchasing steam and electricity with the exception that the steam line to the institutions would not serve other customers. This would allow the return of condensate to the steam station.

The tentative proposal is that MASCO would purchase its electricity needs from Boston Edison and own 85% of a new steam station to be built by Boston Edison on its Station Street site. MASCO would install the

steam line from the steam station to its central chilled water plant and institutional distribution system that would still be required. In this way MASCO would be able to receive 85% of the available steam being produced and condensate could be returned to the station. When the station is at full capacity of 850,000 lb/hr. MASCO would receive 722,500 lb/hr. At this time there is no way of determining the working arrangement if the institutional needs are high while the station output is low due to maintenance.

It has been estimated by Boston Edison that the steam station would cost $12,500,000 which includes 10% escalation through 1978. The institutions share would be 85% or $10,625,000. Distribution from the plant to the chilled water facility and institutional distribution system would be the responsibility of MASCO which MASCO estimates would cost $3,500,000. The total investment of $14,125,000 would ensure 722,500 lb/hr of steam when it is available. This results in an investment of $19,53/lb of steam per hour. In comparison, the proposed MASCO plant investment would be $11,000,000 for a steam availability of 900,000 lb/hr. This results in an investment of $12.22/lb of steam per hour.

In addition to that penalty in first costs, in order to participate in the joint venture with Boston Edison, the institutions would have to forego the savings from the generation of electricity which stem from the integrated production of utilities. It is also unlikely that the advantageous financing arrangements developed for the energy plant would be transferrable to a plant jointly owned with Boston Edison.

Environmental Impacts of Purchasing Electricity and Jointly Owning a Steam Station with Boston Edison

Environmental impacts of this alternative are the same as those of the previous alternative purchasing steam and electricity with the exception of water consumption.

Since condensate can be returned, water consumption due to steam loss would be about the same as for the proposed facility, 28,000 gal/day, with an additional water consumption of 50% due to the increased cooling requirements.

Conclusion

This alternative was eliminated primarily because of Boston Edison's decision not to build the Colburn Street step-down station. This would necessitate an impractical amount of institutional reduction in electrical demand during periods of transmission line overload. Furthermore, even if the step-down station were built the high initial costs for the steam, increased oil consumption, increased costs of electricity, effects of the cooling tower vapor plume from water chilling make this alternative unattractive.

7.4 Alternative Sites

In locating likely areas to build the proposed power plant, the area contained within Huntington Avenue, the Riverway, the Fenway and Ruggles Street was examined because within these boundaries the project would be close to the users of its services, institutional growth would be contained and it is economically advantageous to use land partially or wholly owned by the institutions. Beyond these boundaries the length of distribution system increases and areas of predominantly residential use are encountered.

Within the boundaries described above which have been designated as the project area in this report, seven sites were initially identified as having potential for accommodating the total energy plant. Criteria used in identifying the sites were 1) an expected land use change from its present use due to planned relocation, 2) open spaces that could be used with a minimum of disruption, 3) land areas that could be put to a more institutional use and 4) locations where enough land would be available. The seven sites are shown in Figure 7.4-1, and are briefly described as follows:

Site 1 - the block bounded by Francis, Fenwood, Brookline and Vining Streets. This site is owned by Harvard University and contains 27 multifamily frame houses. When portions portions of the planned Mission Park Housing Project are complete it will provide homes for residents now on this site wich would enable the site to be used for a more institutional use.

Figure 7.4-1 Alternative Sites for the Energy Plant

Site 2 - the block bounded by Francis, Brookline, Deaconess and Binney Streets. This site is partially owned by Harvard University and Children's Hospital and others and currently has institutional uses that are planning to move to new buildings.

Site 3 - this site is owned by Angell Memorial Hospital which is planning to relocate.

Site 4 - this site is owned by the Boston Hospital for Women which is planning to move to the Affiliated Hospital Center when it is completed.

Site 5 - this is the Harvard Medical Quadrangle, an open area in front of the medical schools. It is owned by Harvard University.

Site 6 - this site owned by Harvard University is occupied by the existing university powerhouse. It is scheduled to be razed when the new power plant is ready.

Site 7 - this site owned by Harvard University is now planned to be used for the Mission Park Housing Development.

After these potential sites were identified, a closer examination showed that use of four of the sites, 3, 4, 5 and 6 would not be realistic. Sites 3 and 4 were eliminated from further investigation because use of the sites would require immediate relocation of hospitals in order to build the project on time. Neither Angell Memorial Hospital nor Boston Hospital for Women have begun construction on new facilities and they cannot relocate until such facilities are available. Site 5 was eliminated from further consideration because of lack of space and significant costs required to underpin the perimeter of the site. In addition, this site only has good access to Longwood Avenue and a major construction effort could further harm an already bad traffic situation. Site 6 was eliminated because of structural difficulties. As explained previously in this section, it is not possible to discontinue operation of the existing powerhouse while a new energy plant is installed. The alternative considered was to build the proposed project above the existing powerhouse. In order to do this, the total

energy plant base would have to be 80 feet in the air and some structural "legs" would have to be built through the existing powerhouse. Since each diesel engine and foundation weighs approximately 350 tons, the structural work would have to be extensive to ensure a vibration and sway free structure with enough open spaces to allow the later removal of the existing plant. Furthermore, since the working space would be very confined and would be adjacent to facilities of Children's Hospital, it is expected that excessive disturbances would be experienced by those facilities. The remaining sites, 1, 2 and 7, are feasible locations for the project.

Each of these sites was considered to determine if additional institutional uses could be accommodated. Initial designs for sites 1 and 2 showed that a 5-story parking garage and a warehouse could be placed over the power plant by putting the plant underground. This arrangement would provide some open space for a park. However, preliminary borings in the area showed that a below grade plant would extend into the water table which would increase construction costs and could cause structural problems in the area. During construction, water seeping into the site would have to be pumped out to maintain a dry working area. This, in turn, could lower the water table in the surrounding area causing changes in the foundational stability of existing buildings. The proposed project would have to be anchored to keep it from floating or continuous pumping and discharge of the water would be required. Because of these problems, this plan was abandoned. Since neither site is large enough to accommodate the power plant plus a garage and warehouse, if placed side by side, the garage and warehouse were not included in the project for sites 1 and 2.

On site 7, incorporation of only the power plant was considered to minimize interference with the housing development.

Constraints of Sites 1, 2 and 7

Use of site 1 would require the immediate relocation of occupants of approximately 68 dwelling units. When the Mission Park Housing Project is complete, these people can be relocated with a minimum of inconvenience. However, if site 1 were to be used now, temporary living quarters would have to be established until the housing project is ready.

Site 2 contains the Frederika Home which would have to be relocated before construction could begin. Because of this, site 2 was reduced in size, and the description of the remainder of this site is in Section 4 of this report.

Site 7 would be within the Mission Park Housing Development and would require either a redesign of the existing housing development plans to incorporate the project or placing the plant on a site bordered by Vining Street, Fenwood Road, Kempton Street and Mission Park Drive. This latter location was selected because the site offers a low water table, good truck access and the possibility of incorporating the plant stack within a high rise structure. It would also require relocation of 20 housing models containing 30 units. It was felt that these units could best be placed along the Fenwood Road and Mission Park Drive edges of the power plant.

Of the three sites, site 1 was judged least favorable for construction at this time since it would necessitate moving residents twice. A comparison of the changes of project characteristics caused by locating the plant on site 2 and within the Mission Park Development is shown in Table 7.4-1. It has been estimated that including the total energy plant in the housing project would raise the cost of that project by about $2,585,000.

It was decided that the power plant would be best suited on site 2, the proposed site, to avoid time delays of both the housing development and the power plant due to the legal complications of interrelating the projects. Furthermore, it was considered more advantageous to place the project further away from the residential development.

It should be recognized that members of the RTH community had an active part in the site selection and have endorsed the proposed site.

7.5 Alternative Building Designs

Two sets of alternative building designs have been considered. One consists of variations of Brookline Avenue side of the site including refurbishing the existing row houses or eliminating them and having only a small entryway to the plant. These are options to the proposed design of replacing the rowhouses with new office space. The second alternative

TABLE 7.4-1

COMPARISON OF SITE 2 AND THE MISSION PARK HOUSING DEVELOPMENT

Project Characteristics	Location of Project	
	Site 2	Mission Park Development
Plant Layout	Excellent	Fair
Growth	Possible growth through 1999 by addition of 2 diesels	
Schedule	Site preparation can begin after agency approvals and relocation of tenants.	Acquisition of land from the Mass. Mental Hospital requires act of Legislation; relocation of Mass. Mental Offices and families on Fenwood Rd. and Kempton Street
Hard Cost	$2,500,000 to $2,750,000	3 houses on Fenwood Rd. for $150,000; possible $600,000 payment to Mass. Mental Hospital.
Distribution System Cost	Base	$1,680,000 for 1,120 feet of tunnel system - 370,000 for avoiding 1,370 feet of buried pipe - 120,000 for avoiding 1,200 feet of waste tube - 50,000 for avoiding 50 feet of in-plant piping + 1,140,000 plus rent to the city for rent for 530 feet of tunnel in street
Excavation Premium	Approximately the same unless the plant is below grade.	
Truck Access	Drive through parallel to Binney Street and out Francis Street - little contact with residential area.	Back in after pulling in wrong way on Vining Street connector and backing across Vining and garage entrance. Greater contact with residential areas.
MASCO offices	Good location, ample space	No space available.
Roof cost premium	Some decoration	Playfield - 100 psf structure, $385,000 - 55,000 sf @ $7/sf
Perimeter (construction cost)	1,064 ft.	$60,000 - 1,176 ft + 500 sf wall
Mezzanine area (construction cost)	14,080 sf	$100,000 - 24,452 sf
Neighbor relations	No unusual problems - away from dense residential use	Abutting townhouses could be bothered by truck traffic and noise.
Electricity supplied to housing	Regulatory problems	Regulatory problems - DPU & FPC. HEW is concerned. Housing needs electricity before plant will be ready. Capacity used in housing won't be available for future hospital needs.
Stack	Free standing stack	120 ft breeching to connect to high rise. Rent for stack in high rise (eliminates one apt. per floor). Breeching cost $ 30,000 Rent to high rise $275,000 $305,000 Possible free standing stack
Land Use	Safe pedestrian access	Site 2 available for future institutional use. Safe pedestrian access.
Garage at Housing Development	No effect	Delete 88 cars, change layout, move ramps
Plant area (construction cost)	66,850 sf	$150,000 - 77,250 sf

is that of redesigning the project around the piece of property at the corner of Brookline Avenue and Peabody Street that Harvard University may not be able to purchase.

Architectural Treatment and Use of the Brookline Avenue Side of the Site

Refurbishing the Row Houses for Office Space

This plan would consist of doing extensive structural and interior and exterior work to the eight row houses along Brookline Avenue in order to allow them to remain. The benefit of this is to try to create an interesting facade to that side of the plant and to provide office space for MASCO. This aesthetic benefit is very subjective since the refurbished buildings could be appealing. They could also be very incongruous to the rest of the project and the surrounding existing and planned institutional uses. The total aesthetic effect of refurbishing the row houses could be unsatisfactory. A view of this design alternative is shown in Figure 7.5-1.

This design alternative was eliminated because of the work involved in saving the row houses. In order to fit the plant on the site the back portions of the houses would have to be removed and extensive work would be required to ensure the structural integrity of the buildings during construction and operation.

It has been estimated that costs for the renovating would be about $900,000 and would include the following items:

Interior demolition	$ 58,000
Structural and architectural work	435,000
Mechanical and electrical systems	127,000
Plumbing	25,000
Elevator	30,000
Fees and services	100,000
Furnishings	50,000
Contingencies	75,000

The expense for this design alternative and any aesthetic benefit would be lost in 10 to 15 years, when future plant expansion would be required.

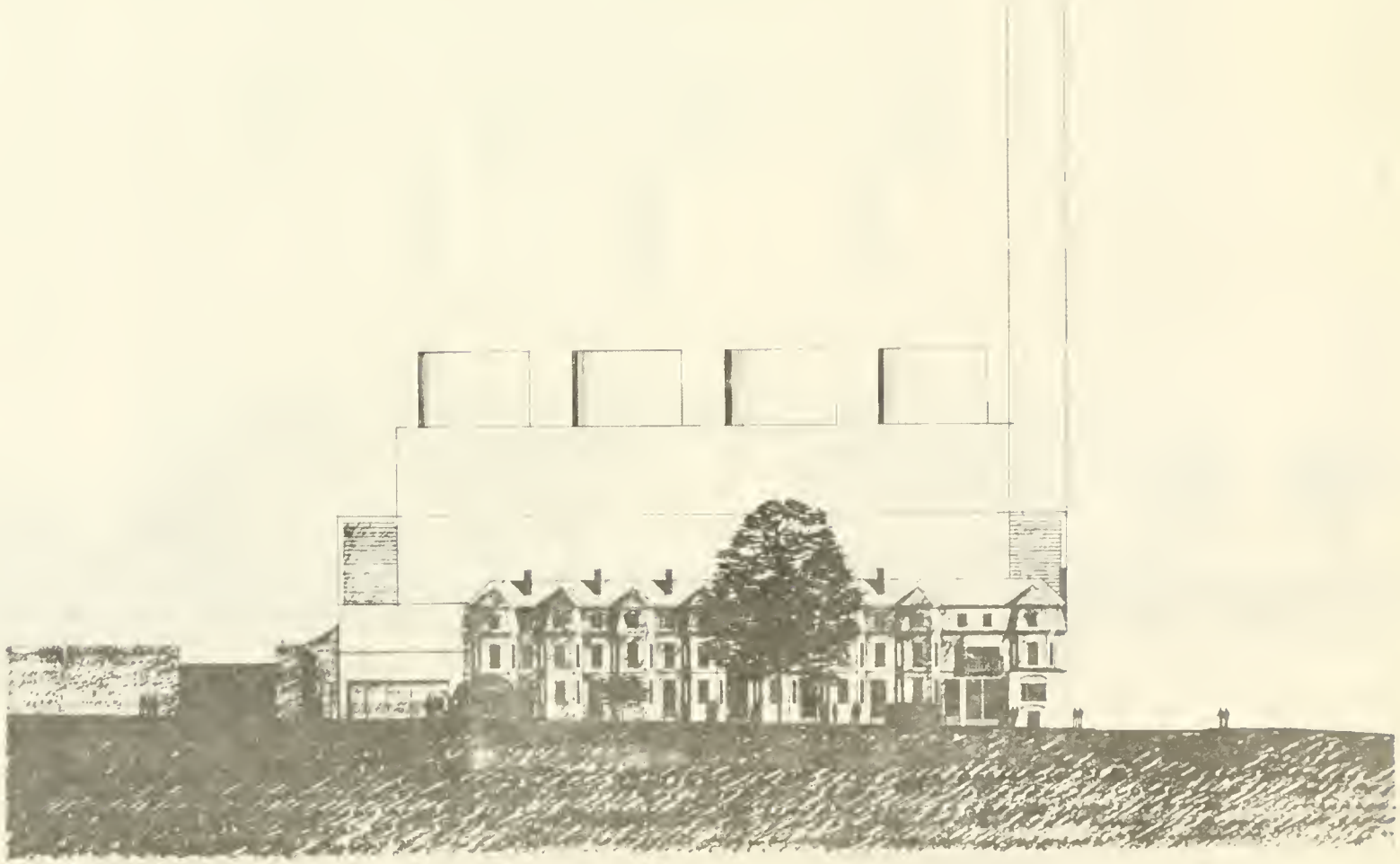

Figure 7.5-1 Brookline Avenue Elevation for the Building Design Alternative of Refurbishing the Roadhouses

It has therefore been decided that removal of these buildings now would be preferable than renovating them.

Small Entryway to the Plant

This design alternative consists of removing the row houses for the reasons mentioned above and adding a small lobby area in the middle of the Brookline Avenue side of the site as shown in Figure 7.5-2. The advantages of this alternative are that it would facilitate future expansion of the plant and reduce the initial cost of the plant by about $1,383,000 by not building the proposed offices.

This design alternative is still viable and its use will depend upon further analysis of all costs involved and the aesthetic effect. There are no significant environmental impacts of this alternative that would differentiate it from the proposed design.

Designing Around the Residential Building

This design is still viable and depends upon Harvard University's ability to purchase the rowhouse at the corner of Peabody Street and Brookline Avenue. If the property cannot be purchased, the following design would have to be used. It consists of constructing the energy plant around the residential property and rearranging the generating equipment. Figure 7.5-3 shows a plan view of the diesel area and how it would relate to the rowhouse. This rearrangement would be necessary because of smaller space available. As can be seen in Figure 7.5-3, Peabody Street would remain to allow the owner access to the easement that exists at the back of the private property. The view from Brookline Avenue of this design alternative is shown in Figure 7.5-4.

The benefit of this design is that it does not displace a resident who has indicated an unwillingness to sell and it creates more privacy for the owner.

A detailed cost analysis of this alternative has not been done at this time but it is expected that the costs would be about the same as those of the proposed plant with the exception of additional engineering and architectural design.

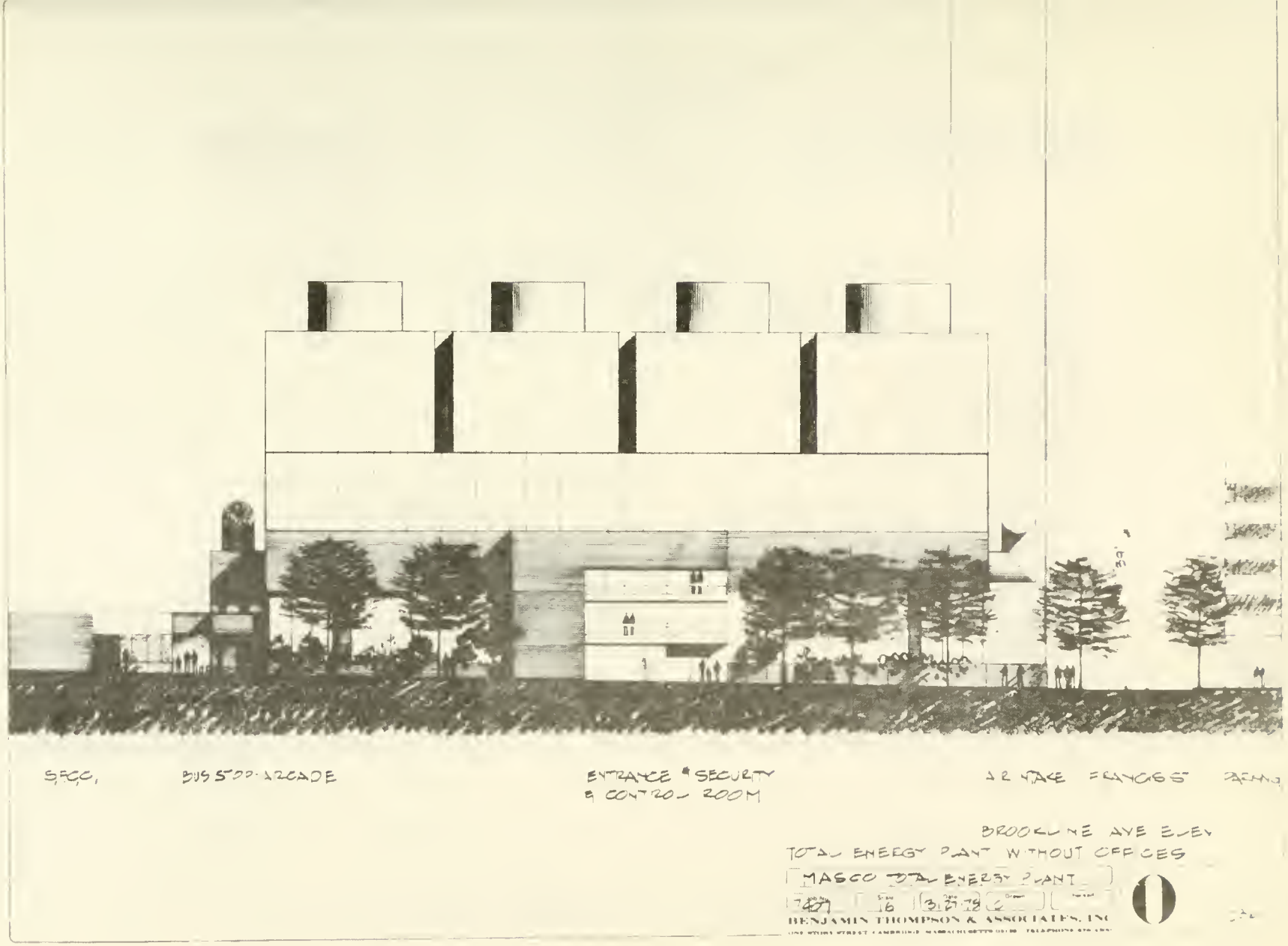

Figure 7.5-2 Brookline Avenue Elaevation for the Building Design Alternative of Providing a Small Entryway

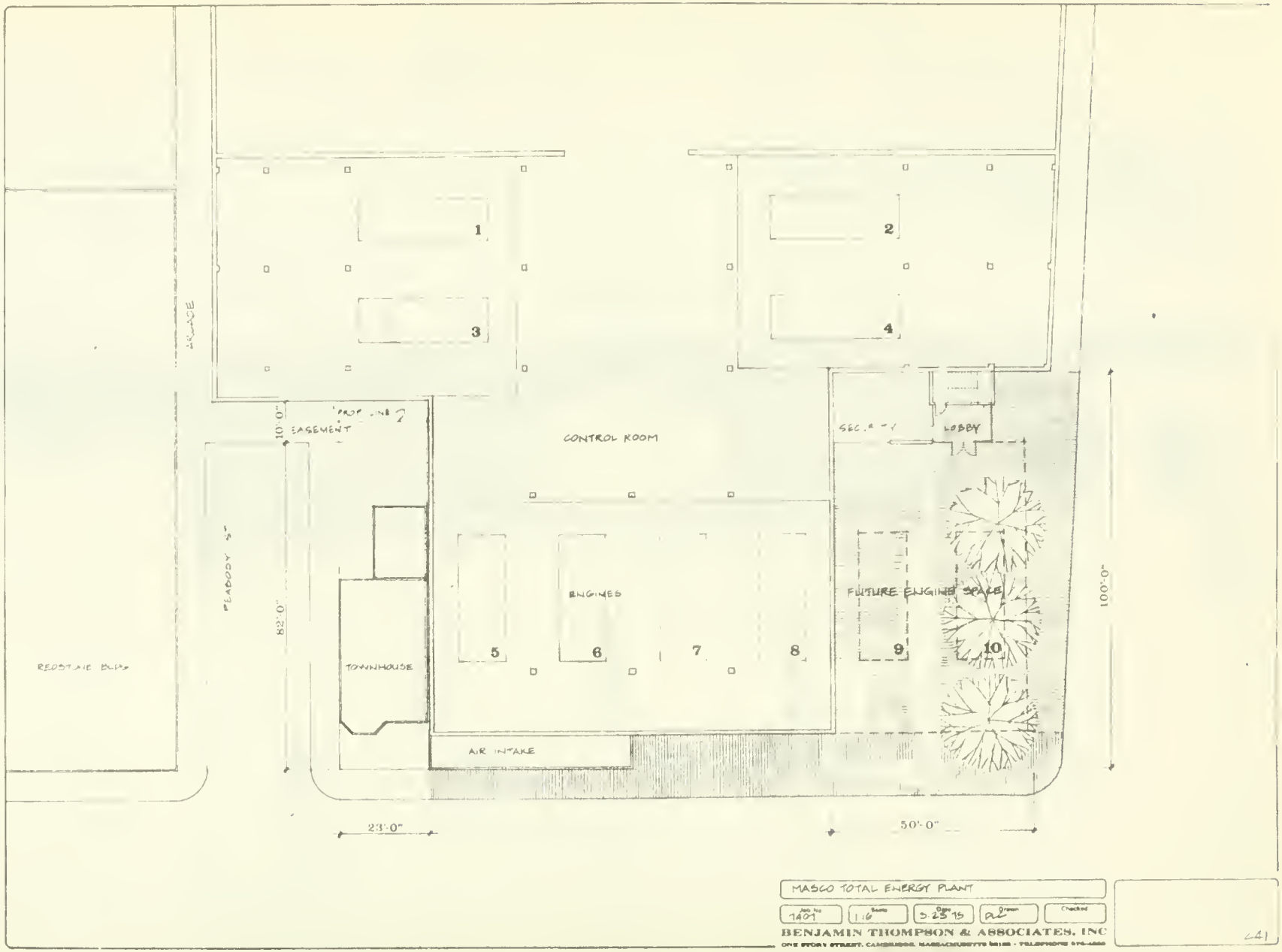

Figure 7.5-3 Plan View of Diesel Arrangement and the Residential Property

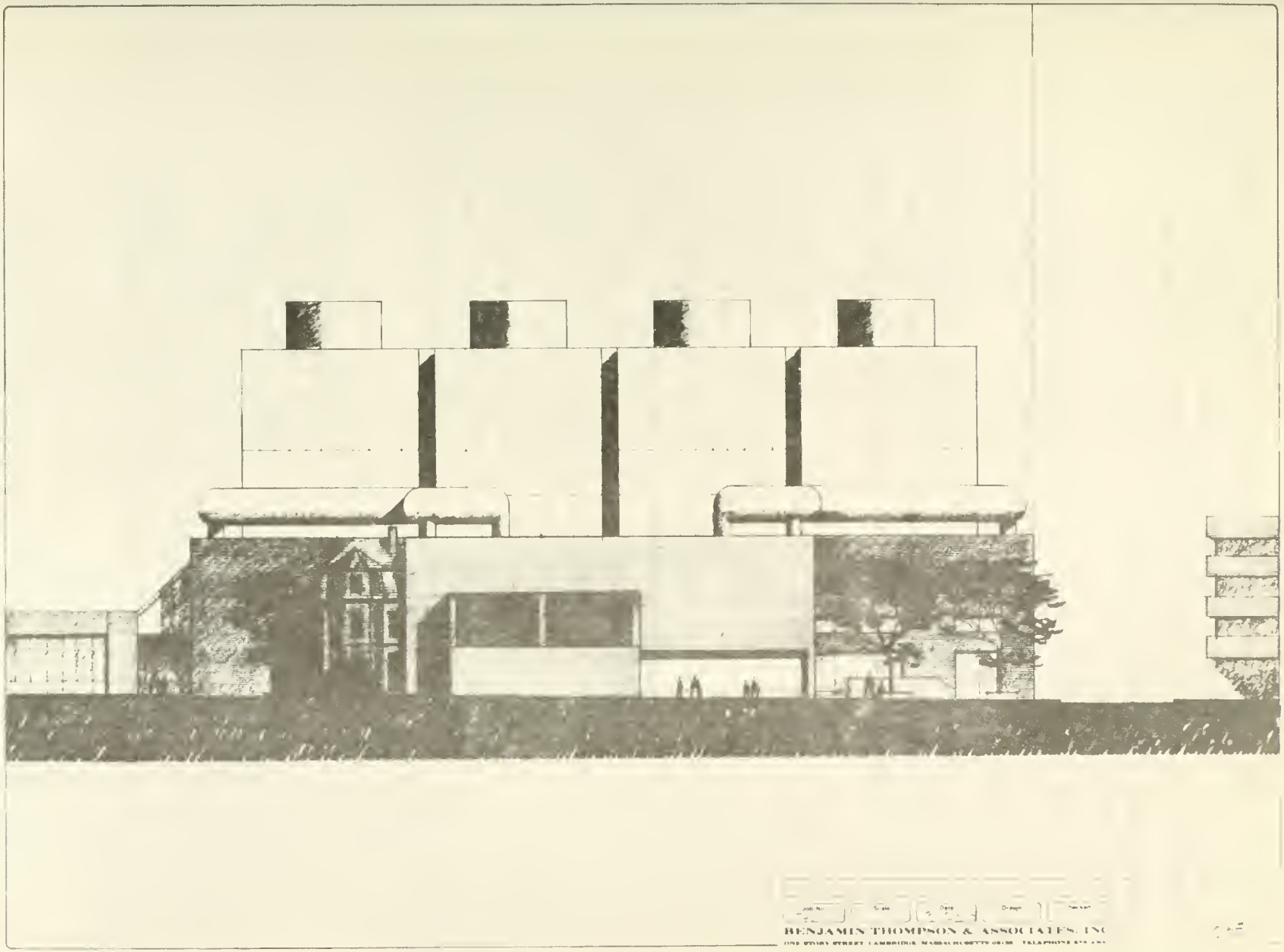

Figure 7.5-4 Brookline Avenue Elevation for the Building Design to Accomodate the Residential Property

The environmental imapcts of this alternative to the site and surrounding area would be the same as for the proposed design with the addition of impacts directly affecting the residential building because of its location adjacent to the power plant.

During construction many activities will be taking place at the property boundaries and could thus be a considerable disturbance to the residents of that building. However, construction activities can be performed immediately adjacent to existing properties. Since activities would be done only during weekdays, little impact would be felt by the owners if they were absent during the day. It is also possible that a high barricade at the property boundaries could reduce impacts of noise and dust.

After a heavy rainstorm, water that collects in the excavation area would have more potential for seeping into the basement since excavation would probably extend to the party wall. The pumping that would be used to remove the stormwater would help minimize this problem. Construction activities would not obstruct the movements of the residents to and from their home or into the medical area.

During operation the residential building would be expected to experience about the same impacts as presented in this report on adjacent areas. The backyard would, however, be in almost constant shade due to the surrounding plant and this could create a feeling of confinement in the residents. The view from the back of the house would be of the side of the plant instead of the existing backyards.

Closing of Peabody Street to motor vehicles may be beneficial to the residents since there would be less traffic passing one side of the house. Design of the plant structure would control noise and vibration imapcts on the residential buildings and the distance from truck area would effectively prevent any noise impact from delivery trucks. Aesthetically, this design would be peculiar when viewed from Brookline Avenue since the single older rowhouse would be in direct contrast to the energy plant.

7.6 Alternative Equipment Designs

Various alternative designs of the project have been considered which could further minimize environmental damage. These alternatives

included different prime movers for electrical generation, alternative fuels, other pollution control equipment, off-site fuel unloading and water recycling. It was judged that the overall proposed design is the best for reliable and economic operation while controlling environmental impact.

Alternative Prime Movers

Steam Turbine Driven Generators

A 10,300 Kw back pressure steam turbine has been incorporated into the proposed facility to use the available steam to generate electricity before it is distributed to the institutions. Under these conditions the heat rate is 4,200 Btu/Kw hr.

If the plant generated all its electricity with back pressure steam turbines, individual generators would have to be on the order of 7,000 Kw in order to maintain sufficient standby capacity to meet increases in load. At this small size the turbine is inefficient and the steam generated to meet the demands of the institutions would not be great enough to first drive the turbines and meet the electrical needs.

Condensing turbines have greater efficiency as a result of a larger pressure differential across the turbine created by condensing the steam coming out of the turbine. However, condensing the steam presents large cooling requirements which lowers the overall efficiency of electricity generation.

Gas Turbine Driven Generators

Gas turbines which exhaust into heat recovery boilers are being used in various installations to produce both base loaded and peaking sources of electrical power. Since the exhaust heat from the turbine can be recovered in a boiler, the operating temperatures and efficiency can be increased. However, higher installed costs, higher heat rate, possible lower reliability and increased maintenance problems have made them less desirable for this installation.

A gas turbine heat rate over a year's operation, including the heat credit for steam produced in the heat recovery boiler, would be about 10,000 Btu/Kw hr compared to the overall heat rate of the diesels of

about 7,000 Btu/Kw hr. This means that the gas turbines would use about 1-1/2 times the fuel used by the diesels. Repairs to a gas turbine could be more damaging to the plant reliability than repairs to the diesels since not all gas turbine repairs could be conducted in the plant and thus repairs could take longer.

An advantage of the gas turbines is that they produce a smaller quantity of NO_x than do diesels. A properly controlled gas turbine could produce NO_x at a rate of 0.3 $lb/10^6$ Btu heat input. The proposed diesels have an NO_x emission rate of about 2.9 $lb/10^6$ Btu. Even though the gas turbine would require 50% more fuel than the diesels, its emission of NO_x would still be lower.

Alternative Fuels

Natural Gas

While natural gas is the cleanest fuel for use in the project, the uncertainty of its future cost and availability have removed it from serious consideration. At the present time natural gas, being price regulated, is less expensive than oil. However, present curtailments and assignments to priority users such as private residences make assurance of a dependable supply at low cost impossible.

Natural gas is a clean fuel since it has a virtually no sulfur or ash to produce SO_2 or particulates. Emissions of NO_x from the diesels would increase by about 20% when gas is used. However, this would be offset by a 30% reduction in NO_x generated in the boilers. All the proposed equipment is capable of being adapted to gas firing if it becomes available.

Coal

Coal is also a less expensive fuel than oil; however, its storage and handling problems and increased level of contaminants make it inappropriate for use in an inner city location. With a heat content of 12,000 Btu/lb a 21-day supply of coal would weight about 9,000 tons and could form a coal pile 200 feet long, 65 feet wide and 25 feet deep. Underground storage would be required to limit aesthetic impact and coal

pile runoff. Movement of coal to the site, storage, transfer to the combustion equipment and removal of larger quantities of collected ash make this fuel unattractive in the medical area. Furthermore, coal cannot be used directly in the diesels and this would require a different method of generation or a process for gasifying the coal to be included in the project.

Nuclear Fuels

Nuclear fuels have not been considered since regulations established by the Nuclear Regulatory Commission would not allow its use in an inner city site.

Alternative Air Pollution Controls

Electrostatic Precipitator

An electrostatic precipitator for removal of particulate matter from the flue gas was judged to be of little advantage for this installation because of the expected low concentration of particulates. The precipitators operate by charging particulates as they enter and having them be attracted to collecting plates. The plates are periodically rapped or vibrated to shake the collected material to the bottom of the precipitator where they are removed. Experience with particulates from oil firing has not been entirely satisfactory since the particles either are difficult to charge or do not release their charges to the collecting plates and become reentrained in the air flowing through the precipitator rather than sliding down the plates.

Gas treatment such as the addition of SO_2 or ammonia has been required to make the precipitators more efficient. The installed cost of electrostatic precipitators plus the operating cost to supply the high voltages required makes them unattractive economically.

Baghouse

A baghouse consists of a number of filter bags that the flue gas must go through before reaching the stack. The bags are shaken periodically or subjected to a reverse air jet to allow the collected material

to settle in the bottom of the collector for removal. This device may be more efficient in collecting small particles than the proposed cyclone since smaller particles are collected as a cake builds up along the filters. Operating costs are higher for this device than the proposed multicyclone since the bags require replacement depending on the temperature and frequency of shaking. One problem with the baghouse is that a rupture in one of the filter bags could go unnoticed between regular maintenance checks and most of the flue gas would pass through the rupture untreated because of the lower resistance to flow. Furthermore, gas velocities through the filters should be less than 4 fps which necessitates a large sized collector. This device was not selected because the expected low particulate concentrations do not warrant the high operating and maintenance costs.

Scrubbers

Scrubbers are used to remove particulates and SO_2 from flue gases by having the contaminants impinge on a wetted surface or on water droplets. The design changes depending on whether particulates or SO_2 are the main contaminant of interest. Lack of continuous reliable operation and disposal or treatment of the collecting water has made this alternative unattractive. If a higher sulfur oil is stored on the site for use in conjunction with the scrubber, failure of the scrubber would necessitate shutting down the plant to prevent increased emissions of SO_2. Scrubbers also create a water problem since the scrubbing solution must be either dumped or recycled. The exact quantity of scrubbing solution for this project has not been determined. A final problem with scrubbers would be the resulting visible water vapor plume that is produced when the flue gases become saturated.

Methods of NO_x Removal

Methods for removing NO_x from flue gas are being developed. Wet scrubbing with a chemical additive and ordinary absorption (silica gel) were rejected because of low efficiences at stack concentrations. Other methods of controlling NO_x such as absorption on molecular sieves or catalytic reduction still require considerable basic research and development before they can be of commercial importance.

Offsite Oil Storage

In order to avoid any impact of oil delivery trucks visiting the site, an offsite oil storage was considered connected to the site by an underground pipeline. This idea was eliminated because the oil storage would have to be in a more isolated area before any overall reduction in truck traffic impacts would be felt. This would require a long, heated pipeline with pumping stations along the way. It was felt that this would be less desirable than the proposed onsite storage.

Water Recycling

It does not appear that recycling discharge water is necessary or would warrant the costs involved since the proposed design will not have an adverse impact.

8. WRITTEN COMMENTS BY REVIEWING AGENCIES AND THE PUBLIC AND RESPONSES BY THE APPLICANT AND/OR AUTHORITY

This section of the report contains comments and responses generated by various state and local agencies and the public during the review period of the Draft Environmental Impact Report. The first letter in this section is from the Boston Redevelopment Authority concerning a report prepared for the BRA by the firm, Parsons Brinckerhoff Quade & Douglas, Inc. Response to the issues raised immediately follows the letter. Then the agency and public comments are presented. Each comment is indexed by a circled number and responses to those comments complete the section.

BOSTON REDEVELOPMENT AUTHORITY City Hall / Room 900, 1 City Hall Square / Boston, Massachusetts 02201 / Telephone (617) 722-430

September 25, 1975

Mr. Daniel Pincus
Environmental Research & Technology, Inc.
696 Virginia Road
Concord, Massachusetts, 01742

RE: MASCO Total Energy Plant

Dear Dan:

Under separate cover I have forwarded to you a copy of a report prepared for the Boston Redevelopment Authority by Parsons, Brinkerhoff, Quade, and Douglas, Inc., which reviews the technical aspects of the Draft Environmental Impact Report prepared by ERT for the MASCO Total Energy Plant. The purpose of this review was to provide an independant evaluation of the estimates of fuel oil consumption of the proposed facility and to examine the methodology employed in the preparation of the air quality analysis.

In summary, the Parsons report concluded that:

(1) The methodology used to determine annual fuel requirements was no longer a recommended methodology, which results in "grossly approximate" estimates, and is not advisable where maximum degree of accuracy is required.

(2) Sufficient base information and documentation was not available to perform a complete analysis of fuel consumption demands using a more appropriate methodology.

(3) There was no reason to believe Edison's estimates were more accurate than MASCO's.

(4) Sufficient documentation was not available to justify the use of No. 6 fuel oil.

(5) Although complete data for an informed evaluation of overall plant performance was not available, the proposed plant design concepts and major equipment selections seemed appropriate to meet widely varying loads with a high degree of flexibility and with good efficiency.

(6) The air quality analysis methodology was based on established procedure and at a level of detail commensurate with available data; however, more detailed analysis was felt desirable.

(7) Even if Boston Edison's fuel consumption estimates were correct, no additional violations of air quality standards would result (save for particulate levels which already exceed standards).

As a result of questions raised in the Parsons report and recommendation which are made, I would request that the following additional information be provided as part of the Final Environmental Impact Report:

(1) Appropriate responses should be made to the findings and conclusions of the Parsons report, including justification for the methodology used to determine the annual fuel requirements.

(2) Plant emmissions during transient periods of start-up and shut-down should be estimated and worst-possible impacts re-evaluated.

(3) Although not exlicitly stated, the Parsons report implies that fuel consumption possibly could exceed the 27,100,000 gallon estimate for 1990. Even if this consumption did approach the 37,500,000 gallon estimate of Edison, the report concluded that no violation of air quality standards would result (except for particulates). Therefore, an analysis of the pollutant estimates for the upper limit (37,500,000 gallons) should be included, together with a comparison with existing standards.

(4) An analysis of future hydrocarbon and ozone concentrations levels should be included.

(5) Together with the pollutant analysis of a higher fuel consumption, increased truck generation should be evaluated, including the net effect on areawide truck traffic and an analysis of associated traffic pollutants. CO analysis should be related to appropriate street geometry and meteorological conditions.

(6) Additional justification on the selection of No. 6 fuel oil as the primary fuel should be provided.

I should like to note also that this additional data must be provided prior to the Authority's determination on the Chapter 121 A application for this project. In addition, a copy of the report is also being forwarded to the Department of Environmental Quality Engineering, which is jointly filing the Final E.I.R. with the BRA, and further concerns may be raised by them.

Please feel free to call me should you have any questions concerning the above.

Sincerely,

Richard B. Mertens
Environmental Review Officer

RBM/bap

cc: Hyman Steinhurst, DEQE
David Elovitz, MASCO
Michael Benn, Harvard Planning Office
Donald Moulton, Harvard University
Steve Lindsey, Esq., Ropes & Gray
Robert T. Kenney, BRA
Charles Speleotis, Esq., BRA

Response to the Letter From the Boston Redevelopment Authority Dated September 25, 1975

The estimate of fuel use conducted by Paul L. Geiringer and Associates has been based on two separate determinations, (1) the equivalent full load hour technique, EFLH and (2) ratio of fuel consumption per square foot based on current energy usage and area of the institutions. Since both these methods have good agreement for fuel uses for the year 1980, about 23,000,000 gallons, application of each technique seems appropriate for this project.

It should be recognized that other methods of determining fuel use such as hour by hour energy and thermal balances can only be as accurate as the information on which they are based. In the case of the medical area institutions, no hour by hour energy use information could be obtained for all the buildings which will be served by the energy plant. Since estimates would have had to be made of hour by hour use of all the institutions, the final results would only have been approximate. Therefore, it is not believed that other methods of estimating fuel use would have been more accurate than the methods used.

Efforts were made during the estimation of fuel usage to use assumptions that would result in a conservatively high quantity of fuel. This plus the fact that design of new buildings in the area, such as the proposed Affiliated Hospitals Center have been directed towards more energy conservation and efficiency than existing buildings should make fuel use estimates higher than those which will actually occur. Moreover, MASCO has undertaken programs which have and are expected to further reduce energy needs. This also increases the conservatism of the fuel estimates.

It should also be understood that a highly accurate estimate of fuel use has not been necessary since the plant combustion systems has been designed to be very flexible in meeting widely varying loads.

Emissions from the total energy plant during the transient periods of start-up and shutdown have not been considered a concern because of the characteristics of the equipment selected. Increased emissions, especially particulates, are a function of fuel to air ratios, length of time of the transition period, and the type of fuel used during start-up. The diesels have a very short transition period, approximately

60 seconds, from pressing the start button to full load operation. The engines are first started with compressed air, then light fuel oil is used to bring the engines to about 30% of load before the No. 6 fuel oil is used. Load is gradually applied to the diesels over the start cycle to allow stabilization of speed and to avoid creation of extra emissions. The start-up cycle and the short transient time precludes any measurable pollution effect during start-up. Shutdown of the diesels also creates no problems since this is done by removing load and shutting off the fuel.

The boilers are ignited with No. 2 oil in the same manner as a residential boiler. No. 6 oil is injected after enough steam pressure has been generated for steam atomization. This fuel switch during start-up reduces the potential for improper combustion which is the cause of increased particulate formation. The use of diesel and incinerator exhausts in the boilers also reduces the potential for improper combustion since the boilers and combustion air will be warm prior to ignition with the No. 2 oil. A further precaution against improper combustion is the use of the Coen windbox and forced draft fans controlled by the oxygen content of the combustion air. These controls modulate the combustion air and ensure that enough oxygen is present for complete combustion.

Based on past experience with package boilers, the Riley Stoker Corporation, manufacturers of the boilers, do not foresee any emission problems during start-up. Shutdown creates no problems since this is accomplished by shutting off the fuel supply.

A brief analysis has been done to show the air quality effects should 37,500,000 gallons of oil per year be burned in the energy plant. The estimate of air quality impact is based on both maximum hourly and annual oil uses. If all the generating equipment were operating at full load, the fuel use and emissions would be as follows:

5 diesels X 450 gallons/hour/diesel = 2,250 gallons/hour

(one diesel of the six diesels would have to remain on standby)

3 high pressure boilers X 1,640 gallons/hour/boiler = 4,920 gallons/hour

1 medium pressure boiler X 1,400 gallons/hour/boiler = 1,400 gallons/hour

(one boiler would have to remain on standby) 8,570 gallons/hour

Emissions from this operation are as follows:

SO_2	=	669 lbs/hr
Particulates	=	62 lbs/hr
NO_2		
From diesels	=	946 lbs/hr
From Boilers	=	275 lbs/hr
		1,221 lbs/hr

The addition of emissions from the incinerators results in the following maximum hourly emissions:

SO_2	=	771 lbs/hr
Particulates	=	68 lbs/hr
NO_2	=	1,223 lbs/hr

Operation of the equipment in producing the above emissions would generate approximately 45,300 Kw and 807,000 lbs of steam. Annual emissions resulting from 37,500,000 gallons of which 13,205,700 gallons could be burned in the diesels based on an electrical load factor of 67% and 24,294,300 gallons could be burned in the boilers are as follows:

SO_2	2,925,000 lbs/yr
Particulates	271,875 lbs/yr
NO_2	
From Diesels	5,553,000 lbs/yr
From Boilers	1,056,800 lbs/yr
	6,609,800 lbs/yr

The addition of emissions from the incinerators results in the following annual emissions:

SO_2	2,937,410 lbs/yr
Particulates	310,345 lbs/yr
NO_2	6,619,730 lbs/yr

The following table compares the emissions based on 27,076,680 gallons of oil/year to 37,500,000 gallons. (Emissions include those from incineration.)

	27,076,680 gallons		37,500,000 gallons	
SO_2	580 lbs/hr	2,124,390	771 lbs/hr	2,937,410 lbs/yr
Particulates	60 lbs/hr	234,780	68 lbs/hr	310,345 lbs/yr
NO_2	1,172 lbs/hr	5,630,460	1,223 lbs/hr	6,619,730 lbs/yr

The ratios of the above emissions have been used to scale the ambient concentrations calculated for the 27,076,680 gallon/year fuel use. Concentrations that would result from 37,500,000 gallons of oil per year are presented in Table A along with a comparison to the air quality standards.

The preceding SO_2 concentrations would not cause ambient air quality levels to exceed the air quality standards. The maximum daily and annual SO_2 values measured in the Boston metropolitan area were 0.041 ppm and 0.012 ppm respectively. If the concentrations contributed from the total energy plant were added to those concentrations, the result, 0.056 ppm and 0.0126 ppm, would be below the respective standards of 0.14 ppm and 0.03 ppm.

TABLE A

AIR QUALITY EFFECTS OF THE PROPOSED PROJECT SHOULD IT BURN 37,500,000 GALLONS OF OIL PER YEAR

	Concentration Contributed By The Project	Air Quality Standard	Percent of The Air Quality Standard
On Parker Hill			
SO_2			
3 Hour	0.038 ppm	0.5 ppm	7.6%
24 Hour	0.015 ppm	0.14 ppm	10.5%
Particulates			
24 Hour	3.15 $\mu g/m^3$	150 $\mu g/m^3$	2.1%
Annual	0.09 $\mu g/m^3$	60 $\mu g/m^3$	0.2%
NO_2			
Annual	0.0004 ppm	0.05 ppm	0.7%
On The Surrounding Area			
SO_2			
3 Hour	0.023 ppm	0.5 ppm	4.7%
24 Hour	0.009 ppm	0.14 ppm	6.3%
Annual	0.0006 ppm	0.03 ppm	1.8%
Particulates			
24 Hour	2.14 $\mu g/m^3$	150 $\mu g/m^3$	1.4%
Annual	0.15 $\mu g/m^3$	60 $\mu g/m^3$	0.2%
NO_2			
Annual	0.0009 ppm	0.05 ppm	1.8%

Annual ambient nitrogen oxide levels (measured as NO_2) have not been fully defined because the validity of collected monitoring data is questionable. However, the ambient concentrations that would be contributed by the proposed project if it burned 37,500,000 gallons of oil per year, 0.0009 ppm, would not be a major factor in allowing NO_2 air quality standards to be attained.

Particulate levels that exceed the air quality standards have been measured in the Boston area and thus any fossil fueled facility would violate the standards. However, the high levels measured may not be truly indicative of ambient particulate levels since they were recorded at sites influenced by dirt and dust reentrained in the air by passing vehicles. Monitors more representative of ambient air quality levels in the project area have shown compliance with the air quality standards. At Brookline High School, for example, the maximum 24-hour particulate concentration measured was 102 $\mu g/m^3$. Addition of the maximum concentration contributed by the proposed project if it burned 37,500,000 gallons of oil per year would be about 105 $\mu g/m^3$ which is below the standard of 150 $\mu g/m^3$.

Furthermore, the termination of the existing Harvard power plant would partially offset the effects of the proposed project. Calculations show that the existing power house contributes a 24-hour particulate concentration of 2.44 $\mu g/m^3$ to the ambient air quality. Replacing that plant with the proposed plant would increase ambient levels by 0.71 $\mu g/m^3$. That increase is about 0.5% of the 150 $\mu g/m^3$ air quality standard.

The preceding air quality impacts have not reflected the increased flue gas flow which would increase the rise of the contaminants and result in more dispersion and lower ground-level concentrations.

An analysis of hydrocarbons and ozone has not been included in the environmental analysis for this project since it is not a major traffic generator and should not influence traffic patterns; there are no changes in area parking supply or demand associated with this project. Furthermore the strategy to control oxidant levels promulgated by the Environmental Protection Agency is designed to reduce hydrocarbon emissions on a regional basis. This strategy is directed toward reducing oxidant levels at Wellington Circle in Medford, Massachusetts, to attain

the air quality standards. Since oxidant levels at Wellington Circle are the highest measured in Metropolitan Boston, it is the EPA's belief that once that problem area is resolved that no other problem areas will exist.

A fuel consumption of 37,500,000 gallons of oil per year would result in increased contaminant levels as previously discussed and increased truck traffic to the energy plant. Approximately 6,250 trucks would be required to deliver No. 6 fuel oil to the energy plant. Total truck traffic to the plant could approach 6,350 per year. Representatives of Wilbur Smith Associates, traffic engineering consultants, have considered the problems that could be associated with that number of truck movements. They do not believe that the trucks would present any significant problems. The daily number of trucks would probably not exceed 25, and this number is low in comparison to current traffic volumes. However, the increased number of trucks would increase the potential for having trucks wait on Binney Street or at other places along the route before they could unload at the plant. Since the unloading area can handle four trucks at a time, it is possible to schedule deliveries so that no waiting would be required.

In order to avoid traffic disturbances, the deliveries would probably be scheduled for off-peak and nightime hours. At these times, traffic continuously flows even though it is heavy. Oil companies that make large deliveries have indicated that it is their standard practice to schedule oil deliveries so as to avoid traffic problems.

Mathematical modeling of carbon monoxide levels along Brookline Avenue have been conducted as part of an air quality analysis for the environmental impact report for the affiliated Hospitals Center.[1] This modeling was based on a numerical advection model which includes roadway geometry and meteorological conditions. That analysis indicates that CO levels on Brookline Avenue and Francis Street would be below air quality standards in 1980. The truck traffic from the energy plant would not significantly affect the results of that analysis since truck movements

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[1]Draft Environmental Impact Report for the Affiliated Hospitals Center, EOEA 01772, July 15, 1975.

will be during off-peak hours when lower concentrations exist and there is less potential for causing traffic congestion. Moreover, oil truck movements cannot exceed four in any one hour because of the arrangement of the unloading facility.

Fuel considerations for the total energy plant have included gas, coal, and oil. Of these fuels oil was determined to be best for this application. At this time there is uncertainty of the availability of natural gas. Since curtailments of gas to industrial facilities have occurred, it has not been practical to plan this facility for natural gas. The use of coal would create severe storage and handling problems because of the quantity needed and treatment for use in the boilers. Coal has a heating value that is about 65% of that of oil and would thus require 1.5 times the storage capacity of oil. This would increase fuel shipments and require protection of the coal pile from precipitation runoff and windborne particulates. In addition, higher sulfur and ash content of coal would necessitate more extensive flue gas emission controls which would create additional environmental impacts in this urban location.

Selection of the combustion equipment for burning almost any grade of oil provides the greatest flexibility of operation. This will allow the plant to burn the least expensive fuel that is available. Diesels have been selected that can burn residual oil, No. 6, through most of its operating range since it is believed that No. 6 oil will maintain an economic advantage. Hawker Siddeley Diesels and Electrics LTD, the supplier of the diesels, has guaranteed their performance on the basis of the heavy fuel. As of 1973, 513 diesel installations using the K series diesels proposed for the energy plant were in operation using crude and residual oils. The air quality impacts presented in this report have been based on the use of No. 6 fuel and those impacts are environmentally acceptable. No. 2 fuel oil which has a lower sulfur and ash content than No. 6 would result in lower emissions and ground-level concentrations of contaminants.

WRITTEN COMMENTS BY REVIEWING
AGENCIES AND THE PUBLIC

Evelyn F. Murphy
Secretary

The Commonwealth of Massachusetts

Executive Office of Environmental Affairs
18 Tremont Street
Boston, Massachusetts 02108

STATEMENT OF THE SECRETARY
ON
DRAFT ENVIRONMENTAL IMPACT REPORT

The Secretary of Environmental Affairs herein issues a statement that the Draft Enviromental Impact Report submitted on the below referenced project does not adequately and properly comply with Massachusetts General Laws, Chapter 30, Section 62, and the regulations governing preparation of environmental impact reports.

Environmental Affairs File No. 01540

Submitted by: Boston Redevelopment Authority and the Department of Public Health (now Department of Environmental Qualtiy Engineering).

Date Received: April 30, 1975

Project Identification: Medical Area Service Corporation Total Energy Plant.

The reasons for this statement, set forth in detail below, are intended to guide the authority of the Department in preparing the Final Report.

The Executive Office of Environmental Affairs has had the benefit of a review of this Draft Report by the Center for Environmental Policy Studies, Institute for Man and Environment, University of Massachusetts, Amherst. A copy of the IME report is enclosed, and is incorporated herein by reference.

In addition to the IME comments, the following points should be addressed in the Final Report.

(1) 1. Estimates of the amount of fuel oil to be used per year need clarification. Did the estimates in the report include fuel necessary to meet the demands for steam from the Joslin Clinic and Mission Park Housing Project.

(2) 2. The construction phase impacts of this proposal and the cumulative construction phase impacts of the related Mission Park and Affiliated Hospitals proposals should be carefully analysed and specific proposals to minimize these impacts should be presented.

(3) 3. Alternatives should be more carefully considered and their potential environmental impacts described. The Boston Edison joint venture alternative merits this consideration. Also, the alternative of a coal fired facility should be explored, in light of future uncertainty as to the price and/or availability of oil.

(4) 4. Noise and air pollution projections should include impacts associated with fuel oil delivery (trucks), storage, and solid waste collection.

(5) 5. It is not clear whether water usage and discharge figures in the report included both sanitary usage and boiler blowdown and cooling usage. Both should be considered.

(6) 6. The impacts of this proposal and related developments on the adjacent Olmstead Park System should be explored.

During the review period of this Draft Report, I have received comments from Boston Edison Co., the City of Boston Conservation Commission, and the Office of State Planning. This statement and comments should be responded to in the Final Report.

During the preparation of the Final Report, the staff of this office will be available to advise the Authority and the Department.

7 July 75
Date

Evelyn F. Murphy
Secretary

cc: Commissioner Standley
Attorney General

Review of
Draft Environmental Impact Report
Medical Area Total Energy Plant
Boston, Massachusetts

IME-EIRRP-69; EOEA 01540

Prepared for

the Executive Office of Environmental Affairs

by

the Center for Environmental Policy Studies

Institute for Man and Environment

University of Massachusetts

Amherst

June 1975

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INTRODUCTION

This is one of a series of reviews of environmental impact reports, environmental impact statements, and other projects having to comply with the Massachusetts Environmental Policy Act (M.G.L. Ch. 30, S. 61 and S. 62). This particular report is a review of the Draft Environmental Impact Report for the Medical Area Total Energy Plant, Boston, Massachusetts - EOEA number 01540. This report was reviewed by Center for Environmental Policy Studies staff members under faculty supervision and edited by Ronald B. Woodland, Institute for Man and Environment.

Richard C. Smardon
Associate Planner
Executive Office of
Environmental Affairs

GENERAL COMMENTS

(7) 1. Noise and air impacts should be evaluated in terms of effects on hospital in-patients, medical activities, and the aged who reside in the project locale. As the project area has unique problems in terms of critical receptors, all means feasible should be used to minimize these impacts. The usual considerations of short-term impacts (i.e. one to two months) have less meaning for this project as the average stay of in-patients is shorter than the "short-term" time periods. See Specific Comments 20, 22, 24, 25, 26, 27, 28, 35, 37, 39, 40, 41, 42, 43, 44, 47, 48, 49, 52, 53, 54.

(8) 2. As there are so many on-going projects in the proposed site area, cumulative impacts from all these projects should be evaluated. Every attempt should be made to coordinate the construction activities associated with these projects to minimize noise, air, and traffic impacts. See Specific Comments 19, 26, 27, 37, 42, 43, 44, 47, 53, 54.

(9) 3. Impacts associated with the disposal of demolition, excavation, and other construction and operational phase solid waste materials should be evaluated in terms of the present inadequacy of sanitary landfill space. In addition, impacts associated with liquid wastes (eg. caustic cleaning solution) should be evaluated. Means of minimizing these impacts should be considered in detail. See Specific Comments 14, 23, 30, 31, 31.

(10) 4. Any modification of impacts associated with fuel switching (Massachusetts General Law Chapter 494) should be addressed. See Specific Comment 38.

(11) 5. Details and associated impacts of the stockpiling of construction materials and the staging of construction should be given. See Specific Comment 36.

(12) 6. Adequacy of water supply and pressure should be fully considered. See Specific Comments 45, 46.

(13) 7. Means of minimizing impacts on Muddy River should be considered. See Specific Comments 51, 55.

(14) 8. Growth plans for area medical facilities, as they relate to the proposed project, should be presented. See Specific Comment 15.

(15) 9. Certain alternatives should be evaluated in greater depth including remote siting of the facility. Evaluation of the alternative favored by Boston Edison should consider

information available from Boston Edison. See Specific Comments 56, 57, 58, 59, 60, 61, 62.

(16) 10. Graphics were poorly reproduced in some copies of the Environmental Impact Report.

SPECIFIC COMMENTS

PART II - Summary Sheets

(17) p. 2-12 11. In what ways will the Mission Park Housing Project "help retain the character of the neighborhood"? The comments in the latter part of Section 4 would lead one to suspect that the project will not provide community cohesion for the existing residents.

(18) p. 2-13 12. What techniques are used to allow a 300 foot stack to "blend-in" with the surrounding structures? Design specifications should be presented verifying the height, taper and diameter of the stack.

PART III - Description of the Project

(19) 13. Section 3 should present a tabulation of the proposed distribution of steam, chilled water, and electricity to each receptor.

Type of Project

(20) p. 3-1 14. Does a dependency upon incineration imply an abandonment of efforts toward recycling materials? Do the Medical Area Facilities have any commitment toward recycling? If so, it should be explicitly stated and shown how the project contributes to the policy.

Objectives and Benefits of the Project

(21) p. 3-3 15. One of the major benefits of this project is the ability to allow the institutions involved to control their growth. The aspect of growth and expansion is inadequately dealt with in this Report. Specifically what is the master plan for development that requires a project of this scale and how are the associated institutions going about planning and controlling their growth? This concern is intimately tied to the severe combined impacts which the area will experience over the next five years from these institutions. If further expansion within the lifetime of the proposed plant is a reasonable expectation, then a comprehensive impact analysis of all planned institutional activities in the area should be prepared.

Technical Description

(22) p. 3-17 16. (Figure 3.5-3) The code "0A" should be identified.

PART IV - Description of the Environment of the Area Likely to be Affected by the Proposed Project

Social and Economic Characteristics

(23) p. 4-70 17. Where will the Children's Hospital activities be located?

(24) p. 4-72 18. Apparently the major community input comes from the Roxbury Tenants of Harvard. What is the make-up of the association?

Land Use

(25) p.4-86 to 89 19. The current and proposed construction for this small area is substantial, thus a very good argument can be made for presenting an overall impact report of the cumulative impacts that this area may suffer. This would seem particularly a appropriate since most of the institutions concerned seem to be able to cooperate with one another. Marsh Urban Renewal Project is another project that should be considered.

(26) p. 4-105 20. What are the realistic probabilities of an "adequate shuttle bus service" and "adequate enforcement programs" occuring? Commitments from the concerned agencies should be obtained before it would be reasonable to expect "adequate" results.

(27) p. 4-106 21. (Figure 4.8-12) Approximately 50% of the area's parking will be eliminated. The report does not adequately demonstrate that this problem, already acute, can be dealt with in a reasonable manner.

PART V - Probable Impact of the Proposed Project on the Environment

Construction

General Description of Construction Activities

(28) p. 5-1 22. The noise impacts from a wrecking ball used in a hospital zone are inadequately treated. Alternate

means of demolition should be evaluated for both the buildings on site and for the existing power plant. The in-patients at the various hospitals and the elderly residents should be used as the standard against which to judge all construction impacts in this particular area.

(29) p. 5-1 23. While the contractor may be responsible for the disposal of debris, it is the responsibility of those preparing an Environmental Impact Report to evaluate the impacts of this disposal.

(30) p. 5-3 24. When it is determined to what extent pile driving will be required, this impact should be fully assessed.

(31) p. 5-5 25. The impacts upon noise and traffic caused by the construction of the distribution/collection system to the hospitals and Mission Park are inadequately treated. A clearer map of possible routes should be presented, including the tunnel to Mission Park. Is this facility to be located mostly under road surface? If not, what will the effects be upon neighboring buildings? Such noise impacts as the use of jack hammers over a two-year period, even if at irregular intervals, cannot be ingored. Likewise, it is inadequate to assume that fencing off the main site will protect people, especially children, from construction hazards when an exposed trench will be advancing slowly through the neighborhood.

Air Quality

(32) p. 5-7 & 8 26. The combined effects of truck traffic from this project and others in progress should be evaluated. A detailed plan for cooperative traffic control should be prepared. Means of monitoring CO levels and procedures for updating traffic movement should be developed. Due to the substantial construction activity in the area, coordination between the contractors for the various projects would seem essential.

Noise

(33) p. 5-14 27. Noise impacts should include cumulative effects of all significant sources of on-site noise, plus contributions of other projects in the area.

(34) p. 5-15, 18 28. Critical receptors should be specifically identified and a range of probable noise impacts on all critical receptors should be evaluated. Of crucial importance are the impacts on in-patients of local hospitals, ongoing medical activities, and elderly people. A medical area presents unique problems of noise and air impacts that should be considered.

Social and Economic Characteristics

(35) p. 5-21 29. A fence around the construction area deals with only one portion of the project. What means to minimize hazards from the open trench will be taken? This will be particularly important with regard to children.

Land Use

(36) p. 5-22 30. The disposal of demolition, excavation, and incinerator wastes presents a serious problem given the lack of space in a properly operated sanitary landfill. (Saugus Landfill is not operating in compliance with state regulations). The impacts of disposal of solid waste should take this factor into consideration.

(37) p. 5-22 31. Would the excavation materials be an appropriate cover material for the Saugus Landfill?

(38) p. 5-22 32. The impacts associated with the disposal of all waste material by contractors should be considered in the Environmental Impact Report.

(39) p. 5-24 33. It is claimed that "construction activities will not prevent access to any of the other facilities surrounding the site". However, the impairment of access, especially for emergency vehicles, caused by the tunnel could be significant. What measures will be taken to guarantee freedom of motion for ambulances?

(40) p. 5-24 34. Conflicting statements are made on pages 5-4 and 5-24 concerning the disconnection of utilities. This should be clarified in the Final Environmental Impact Report.

(41) p. 5-27 35. If tunnel construction across Longwood Avenue is

switched to night time, noise impacts for this construction should be reevaluated.

(42) 36. There would appear to be a potentially serious situation involving the lack of area to stockpile construction-related materials. This is only touched upon for the main boilers; other concerns involve the assembly of the stack and cooling towers. A thoughtfully considered staging plan should be presented. As part of the impact of this plan, the amount of potential flexibility in staging should be evaluated. All agreements with the various responsible contractors should consider this assessment.

Combined Construction Effects

(43) p. 5-30 37. While it is noted that many severe "impacts are not produced by any one project but by all, the proposed projects together", no method of coordinating means to minimize harm is presented. A detailed plan to which each of the involved institutions are committed should be presented.

Operation

Air Quality

(44) p. 5-41 & 2 38. What effects will implementation of Massachusetts General Laws, Chapter 494, have on SO_2 and particulate emissions?

(45) p. 5-50 39. Could peak concentrations occur at an operating level other than 50% or 100% of peak load?

(46) p. 5-53 40. Could more severe impacts occur on Parker Hill at operating levels less than peak load?

(47) p. 5-53 & 54 41. Air impacts should consider the effects of increased pollutant levels on in-patients at the various hospitals (particularly those with respiratory or cardiac conditions) and effects on the aged residing in the project area.

(48) p. 5-57 42. Do any sources exist in the immediate project area that would make a significant contribution to the pollutant levels in the project area?

(49) 43. Are any additional projects planned that would make a significant contribution to the pollutant levels in the project area?

(50) p. 5-60 44. Recent studies indicate significant health problems can be associated with sulfates in the atmosphere. Sulfate emissions from the cooling tower should be evaluated in light of this new information and should consider the impacts on the aged, and on hospital in-patients.

Water Quality

(51) p. 5-63 45. Diversion of water from one watershed to another remains a sensitive issue. Due to the high water usage of the powerplant, the Environmental Impact Report should consider impacts of diversion and should recognize that diversion of Connecticut River water to the Quabbin Reservoir may not occur.

(52) p. 5-64 46. It is assumed that the City of Boston will test the pressure in the water mains before allowing the proposed project to tie in. The results of this test should be presented in the Final Environmental Impact Report.

Noise

(53) p. 5-74 47. The combined impact of the machinery and cooling tower noise should be jointly assessed.

(54) p. 5-77 48. What noise levels might be associated with emergency (or scheduled) steam release? What impact would this have on the medical facilities?

Land Use

(55) p. 5-87 & 91 49. How do fuel trucks differ from trash removal trucks in terms of noise impacts and interference with traffic?

PART VI - All Measures Being Used to Minimize Environmental Damage

Design of the Proposed Plant

(56) p. 6-1 50. What procedures will be followed if the incinerator becomes inoperative or stoppage occurs in the pneumatic transfer system?

Construction Techniques

(57) p. 6-3 51. What procedures will be used to minimize construction phase siltation of the Muddy River? As sedimentation basins will not remove a significant amount of clay-sized particles, can other means be used to reduce clay uptake by runoff or

to remove clay-sized particles in the runoff? Is there apt to be a sufficient quantity of larger-sized particles in the storm runoff to justify sedimentation basins?

(58) p. 6-3 52. The degree of muffling for trucks should be specified.

(59) p. 6-4 53. All means of minimizing construction noise impacts on in-patients, medical activities, and the aged should be completely explored.

(60) 54. Means of minimizing noise impacts associated with the construction of the distribution tunnel should be explored.

Operation

(61) 55. Possible action by MASCO that would reduce the adverse impact of storm overflows on the Muddy River should be considered.

PART VII - Alternatives to the Proposed Project and Their Probable Impact on the Environment

Alternative Sources of Utilities

(62) p. 7-5 56. Have any provisions been made for an emergency tie-in with Boston Edison?

(63) p. 7-12 57. It is not clear how much fuel oil will actually be saved by adoption of the MASCO alternative as compared with other alternative schemes. This should be clarified in the Final Environmental Impact Statement.

(64) p. 7-13 58. The assumption that Boston Edison is emitting air pollutants at "emission standard" levels and not below these levels may not be justified. In addition it appears that much of Boston Edison's electricity is provided by the Pilgrim I nuclear power station. The comparison of air quality of the various alternatives should consider these facts. Adverse impacts associated with nuclear power generation should be considered for alternatives where this becomes a factor.

(65) p. 7-18 59. The discussion of the alternative favored by Boston Edison should consider the data generated by or for Boston Edison relating to this alternative(and available in report format).

Alternative Sites

(66) p. 7-20 60. Consideration should be given to a more remote siting of the power facility. All significant trade-offs of remote siting (such as heat losses, distribution tunnel construction impacts, remoteness of critical receptors, siting in a location of better ambient air quality, solid waste transport problems, more convenient fuel delivery, etc.) should be evaluated.

Alternative Equipment Designs

(67) p. 7-34 .61. The impacts on the MBAPCD associated with the significant decrease in NO_x emissions, resulting from gas turbine vs. diesel power generation, should be discussed.

(68) p. 7-36 62. Are other means available to reduce NO_x emissions from the diesels? If add-on devices are developed (such as catalytic converters), would they be installed?

The Commonwealth of Massachusetts
Executive Office for Administration and Finance
Office of State Planning and Management
Leverett Saltonstall Building, Room 909
100 Cambridge Street, Boston 02202

Frank T. Keefe
DIRECTOR

AREA CODE 617
727-5066

June 23, 1975

RECEIVED
JUN 26 1975
BOSTON REDEVELOPMENT AUTHORITY
OFFICE OF THE DIRECTOR

Robert T. Kenney, Director
Boston Redevelopment Authority
City Hall
One City Hall Square
Boston, MA 02210

Re: Review of the Draft EIR Medical Area Total Energy Plant
State Clearinghouse Identifier 75050483 EOEA # 01540

Dear Mr. Kenney:

We have completed our review of the Draft EIR for the Medical Area Total Energy Plant and would like to inform you of our findings.

The following agencies were asked to review and comment on the Draft EIR: the Departments of Community Affairs, Natural Resources, and Public Works; the Coastal Zone Review Center; and the Energy Policy Office.

DCA and DPW have found the report adequate,and the construction of this project will not be in conflict with their programs and policies. The Energy Policy Office has also found the Report adequate and supports the concept of a total energy system (See attached EPO comments.).

This office also has found this Draft EIR adequate and endorses this project which will provide for the conservation of energy.

Sincerely,

Frank T. Keefe
Director of State Planning

FTK/RR/meh

enclosure: EPO comments

cc: Honorable Francis X. Bellotti, Attorney General
Mr. William Hicks, EOEA

The Commonwealth of Massachusetts

Executive Office for Administration and Finance

Office of State Planning and Management

Leverett Saltonstall Building, Room 909

100 Cambridge Street, Boston 02202

AREA CODE 617
727-5066

REQUEST FOR REVIEW OF ENVIRONMENTAL IMPACT REPORT
MASSACHUSETTS STATE CLEARINGHOUSE (727-4154)

TO: Henry Lee, Energy Policy Office

DATE:

REPLY DUE: As Soon as Possible

TITLE OF REPORT: Draft EIR Medical Area Total Energy Plant

IMPACT AREA:

CLEARINGHOUSE IDENTIFIER: 7 t 50 425

The Massachusetts State Clearinghouse has received the above referenced Environmental Impact Report and is referring it to your agency for review and comment. Please focus our review on the technical adequacy of the report within your agency's jurisdiction and expertise. Any conflicts with your agency's programs should be noted. Please comment below, using additional sheets if necessary, and return your comments by the due date noted above.

	REPORT		PROJECT
[x]	Impact report adequate	[x]	Project not in conflict with this agency's programs
[ ]	Impact report not adequate (see comments)	[ ]	Project is in conflict with this agency's programs (see comments)

(NOTE: Please check the appropriate box in each column with respect to your agency's response.)

Explanatory comments:

The Energy Office endorses the concept of total energy systems and is pleased to see that the hospitals are making use of this concept. We are particularly pleased to note the projected conservation of over six million gallons of No.6 oil per year which results from the design of this system. The hospitals' use of the total energy system concept supports our policy position that energy conservation can take place without deprivation to society.

Signature

Date

BOSTON REDEVELOPMENT AUTHORITY City Hall / 1 City Hall Square / Boston, Massachusetts 02201 / Telephone (617) 722-4300

JUL 14 1975

Mr. Daniel Pincus
Environmental Research and Technology, Inc.
696 Virginia Road
Concord, Massachusetts 01742

Re: Medical Area Total Energy Plant Draft Environmental Impact Report - Boston Edison Comments

Dear Mr. Pincus:

Following up on my review of the comments submitted by Boston Edison Company on the Draft Environmental Impact Report for the Medical Area Total Energy Plant, and on our meeting of 10 July with Mr. William Hicks of the Executive Office of Environmental Affairs, I am submitting herewith a summary of those environmental concerns raised by Boston Edison Company which I believe should be responded to in the Final Environmental Impact Report.

(69) 1. Annual fuel oil consumption: basis for MASCO's estimates of 21,453,400 gallons/year vs. Edison's 40,000,000 gallons/year should be fully documented. Included should be responses to the following questions raised by Edison:

(a) Does oil consumption figure include steam and electrical requirements for several new or expanded facilities of the MASCO institutions or is it based solely on the 1973 Geiringer Report?

(b) Does estimate include requirements for heating, hot water, and air conditioning for the Mission Park Housing development?

(c) Basis for annual steam load factor of 34% vs. Edison's estimates, reportedly on their experiences from service to major hospitals, of 55%.

(d) Does oil consumption estimate include steam consumption by the plant itself and auxiliary fuel required for the incinerator? (Edison Report references: IV-11-IV-13, VII-19, VII-23, VII-26, VII-27, VII-39-VII-40, VII-42-VII-43).

(70) 2. Traffic congestion: clarify discrepencies in the calculation of anticipated truck traffic totals and reductions, based on present and future levels; present in a clear manner. Relate to future fuel oil consumption. (IV-3-IV-6, VII-14-VII-15, VII-27-VII-28, VII-31-VII-33, VII-36, VII-37-VII-38, VII-52-VII-53).

3. Noise: impact of truck noise, particularly of oil delivery trucks, on adjacent hospitals and residential areas (IV-9); noise impacts

from plant operation (IV-8-IV-9, VII-10, VII-31-VII-32, VII-43).

(71) 4. Air pollution:
   (a) Understatement of emissions due to underestimation of fuel oil consumption (IV-10-IV-13, VII-6, VII-28-VII-30).
   (b) Impact of use of No. 6 fuel oil (IV-13).
   (c) Lack of measured data from the area of existing air pollution levels (on which to base impact of additional pollution) (IV-13).
   (d) deficiencies in analysis of pollution control equipment and impact from interaction between incinerator and steam boilers (IV-14, VII-28-VII-29).

(72) 5. Stack: unfavorable visual impact, FAA lighting requirements and impact of noise from steam release and soot-blowing (IV-16, VII-10).

(73) 6. On-site oil storage: safety and health hazards which may result (IV-17).

(74) 7. Reliability of plant:
   (a) Reliability of engine generator burning No. 6 fuel oil (V-7).
   (b) Impact of complete dependence on fuel oil as sole source of fuel (V-7-V-8, VII-18, VII-49-VII-50, VII-62).
   (c) Lack of emergency ties with Edison system (V-8, VII-19-VII-20).
   (d) Adequacy of distribution system (V-8).

(75) 8. Alternatives: expand evaluation of Station Street Steam Plant Joint Venture alternatives, to the extent that adequate data are available from Edison, including associated environmental impacts at site and from required distribution system, efficiency and conservation of energy, reliance on nuclear energy by Edison, traffic impacts in adjacent residential areas. (VI-8-VI-13, VII-56-VII-57, VII-58-VII-59).

(76) 9. Land use: compatibility of facility to adjacent institutional and residential uses (facility considered as an "industrial" use) (VII-3-VII-4, VII-8, VII-23, VII-35, VII-53-VII-54).

(77) 10. Other Comments:
   (a) impact on health care costs (VII-2).
   (b) impact on installation of distribution networks (VII-2).
   (c) existing examples of total energy plants (VII-2-VII-3); if data is readily available, analysis of environmental impacts of exisitng total energy plants should be included.
   (d) impact of future expansion of facilities at the plant (VII-20-VII-21).
   (e) cummulative construction impacts in the project area (VII-24-VII-25).

(it should be noted that several other environmental comments contained in Section VII of the Edison Report are repetitious of the

specific comments referenced above).

Should you have any questions on the above, please feel free to call me.

Sincerely yours,

Richard B. Mertens
Environmental Review Officer

specific comments referenced above).

Should you have any questions on the above, please feel free to call me.

Sincerely yours,

Richard B. Mertens
Environmental Review Officer

CITY OF BOSTON AND COUNTY OF SUFFOLK

DEPARTMENTAL COMMUNICATION

May 6, 1975 19___

	(NAME)	(RATING)	(DEPARTMENT-DIVISION)
TO	Richard B. Mertens		BRA
FROM	David Standley	Executive Director	Air Pollution Control

SUBJECT: Masco Total Energy Plan - Pre-draft Environmental Impact Report
Initial Reaction to Environmental Analyses (air quality noise, general)

FILE REF. NO.

The following comments are directed to Chapter 4, "Description of the Environment of the Area Likely to be Affected by the Proposed Project".

Section 4.1 Air Quality

For a project of this magnitude and with respect to contaminants for which there are substantial local variations, such as total suspended particulate matter, carbon monoxide and, for another reason, photochemical oxidants, appropriate (78) on-site analyses of present conditions should be conducted. With respect to photochemical oxidants, the lower level of motor vehicle traffic may, through a reduced production of oxides of nitrogen and reduced scavanging of photochemical oxidants, result in a higher level of observed total oxidant at the location.

On page 4-7 under the heading "Total Suspended Particulates" it is observed that EPA policy (as inferred to the City of Boston during conferences concerning the City's proposal for a new incinerator) would appear to suggest that the (79) sponsor of this proposal must be prepared to demonstrate that the ambient air quality standard for particulate matter must be achieved in the presence of the appropriate test, it is pointed out as a possible condition of approval.

On page 4-8, under the heading "Nitrogen Dioxide" it is suggested that the Boston Traffic Control Plan and emission limitations have some planned and projected relationship to a further reduction of NO_2 levels in the region. This (80) does not appear to be the case. It is however correct that the region is not currently required to promulgate a control strategy for that contaminant pursuant to the Clean Air Act.

On the same page under the heading "Carbon Monoxide", I disagree with the (81) procedure used to estimate carbon monoxide concentrations and refer to my earlier comment regarding the need for on-site monitoring.

On page 4-10 under the heading "hydrocarbons and photochemical oxidants I point to my earlier comment and note that in a region such as metropolitan (82) Boston, lower levels of local traffic may well result in higher observed levels of photochemical oxidant.

Section 4.5 Noise Levels

(83) On page 4-37 it is stated that "the 90th percentile noise level, L_{90}, is generally considered as background". Yet for determining the background noise levels for sites 2-9 (Table 4.5-3) an averaging technique was used that would most likely result in showing that the background level is above the L_{90}. A more accurate technique for determining the L_{90} would have been to use the measurement technique described in "Fundamentals and Abatement of Highway Traffic Noise", prepared for FHWA by Bolt, Beranek and Newman, Inc., June, 1973. This describes a measurement procedure to find the L_{10} level. But it can be just as readily used to determine the L_{90} level.

Using daytime weekday and Sunday readings does not give a fair assessment of the noise present at the site. It would seem reasonable that repeated efforts should have been made to get usable nightime measurements. For the measurement sites which are affected by the present cooling tower, the measurements should have been taken with the cooling tower shut down.

Chapter 5. Probable Impact of the Proposed Project on the Environment

Section 5.1 Construction

Demolition

(84) Any major demolition project should be required to identify the manner and location of disposal of demolition debris. Given the uneven state of regulation of land fill operations and the possibility that this debris will end up being burned on a barge operating out of Boston and allowed to smolder and cool near Spectacle Island, it is necessary to be concerned with this matter. I recognize the difficulty at this stage of identifying contractor, method, or location of disposal or salvage, and suggest the possibility of an adenda to the final EIS to be promulgated at a later date.
fugitive dust during demolition require amplification. Procedures are required for the control of dust and dirt created by trucks moving in and out of the site, especially during excavation but also during demolition and other construction phases. At the least, frequent sweeping of streets in the vicinity is mandatory. Depending on the soil conditions and water conditions in the site, it may be necessary to institute more vigorous measures to prevent the tracking of dirt out of the site.

(85) There is no discussion of the noise impacts of pile driving, no discussion of measures to abate that noise impact, and no discussion of an alternative, "slurry-wall" construction such as is being employed at the 60 State Street site.

(86) The manner of steel erection is not specified. It should be made clear that riveting will not be utilized. It should be understood that complete enclosure of portions of this structure would be required during the spray application of any thermal barrier.

(87) The hours of construction are specified as "7:00 A.M. to 4:00 P.M." We believe that in this area the commencement of construction prior to 8:00 A.M. is inappropriate, and it should be clear that no on-site activities of any sort should take place prior to the designated hour for "start of construction".

(88) Careful attention must be paid to dust conditions and noise conditions in connection with street openings. Attention is directed to the regulations of this Commission covering that subject.

Section 5.1.2 Air Quality

Fugitive Dust

(89) The discussion of controls is inadequate.

E ssions from construction trucks

(90) Without quarelling with the method used to estimate emissions from those vehicles, it is necessary to point out that the resulant concentration is based upon a method of estimation which has been criticized earlier in this memorandum.

It is obviously necessary to regulate truck movements and traffic controls, but there is no plan for so doing.

.mpact of construction workers vehicles

(91) A more likely impact of construction workers vehicles is competition for legal and illegal on-street parking spaces in the vicinity of the site.

Section 5.1.4 Water Quality

(92) Pumping of water from the construction site to the Muddy River should be through equipment designed to reduce solids discharge substantially, in order to avoid problems with settlable or suspended solids and turbidity in the river. An alternative possibility would be the construction of a sump at a point on the site in order that storm water runoff could be permitted to percolate to the ground water table.

Section 5.1.5 Geology and Geohydrology

(93) The discussion of the potential problems associated with spoils disposal is good. What is lacking is a proposed solution. Under the present circumstances it is likely that the anticipated problems will in fact occur.

Section 5.1.6 Noise

(94) Apparently noise from regular operation of the power station will not result in a problem. An exception (except for the question of trucks which is discussed elsewhere) to this is the operation of emergency steam relief valves. The emergency

steam relief valves at the Boston Edison plant in South Boston are blown on the average of once every one to two weeks (varying estimates). Measurements taken during the setting of the new emergency relief valves for the new generator at the Mystic Station of Boston Edison indicated that noise levels reached 86 dBA at a distance of 2000 feet. The new MASCO station may experience fewer blowoffs from emergency relief valves, but each event could still result in a serious problem, especially if one occurs in the early morning. The effect could be a noise level of over 100 dBA at 100 feet. Consideration should have been given to the possibility of controlling this noise source.

Section 5.1.9 Land Use

Impact upon adjacent land uses

(95) Construction activities will be required to comply with the noise limitations established by recently adopted regulations of this Commission. At some point the measures to be taken to achieve that compliance should be detailed.

Solid Waste Disposal

(96) See the comments related to demolition debris and spoils disposal. It is pointed out that the Lynn Marsh dump will probably be closed for such purposes by the time this construction commences, since the incineration facility will be in operation.

Transportation

(97) The most serious problems appear to be the potential problem created by construction workers attempting to park onstreet, which they may well do despite the availability of alternatives; and conjestion problems caused by construction-associated trucking. I believe a plan should be generated at this point to control that problem. It is necessary that there be not only a description of the environmental impacts but of the measures taken to minimize that impact.

Section 5.2.2 Air Quality

Emissions Regulations

(98) It should be noted that Section 150A, Chapter 111, Massachusetts General Laws requires an assignment of site for these proposed incinerators. It should also be noted that the Air Pollution Control Commission regulations also impose an emission limit of 05 pounds of particulate per million BTU input to the plant. In table 5.2.2-1 on page 5-35 it should be noted that the Massachusetts Department of Public Health Regulations for the Boston Metropolitan Air Pollution Control District do impose a limitation on particulate matter from diesel driven generators. In general, however the application of emission standards and calculation of emissions seems to be well handled. On page 5-40 the discussion of boiler modifications to achieve compliance with emission limitations on oxides of nitrogen should be accompanied by a discussion of the impacts of those changes on emission rates of other contaminants. On page 5-42

there should be a discussion of the use of additives to control the formation of "acid soot". On page 5-43 emissions from the existing and proposed plants are compared. Reference is made to an earlier comment in this memo regarding an EPA policy in this respect.

Impact on Ambient Air Quality

(99) On page 5-44 it is estimated that a reduction of a load to 50% will result in a equivalent reduction in emissions of all contaminants. That, I believe, is a questionable assumption with respect to particulate matter. It should be recognized that the use of a mathematical diffusion model introduces a substantial uncertainty into the calculated results, inasmuch as it was developed for open terrain conditions, not for urban areas. In addition, the model results for ground level concentrations are probably valid only within a factor of plus or minus 3 times the calculated value (according to Turner's Workbook).

(100) It is necessary for some party to calculate the resultant ambient air quality assuming the construction and operation of this facility and modification of the regulations of the Massachusetts Department of Public Health regarding sulfur content of fuel as proposed and heard on March 26, 1975. In addition the establishment of an Edison steam plant on Station Street should be considered.

Concentrations on Parker Hill

(101) The report, including the appendix, does not include a justification for the statement that the plume will deflect over Parker Hill (although this is presumed by me to the case). However, there are existing buildings on Parker Hill and plans for the construction of others. The structures should be incorporated in the consideration of the impacts on that location.

Elevated Receptors

(102) This discussion is appropriate. It indicates that the most critical condition will be found at the Children's Medical Center Apartment Building, where the 3-hour and 24-hour SO_2 exposures attributable to the proposed source would exceed 10% of the applicable ambient air quality standard. At this location it is projected that the 24-hour concentration of particulate matter due to the proposed source might approach 10% of that portion of the applicable standard which may be considered attributable to controllable sources of particulate matter. While there are no guidelines for this type of consideration I believe that contributions of this magnitude should be considered excessive.

Cooling Tower

(103) The calculated deposition of particulate matter from drift attributable to the cooling tower seems excessive in comparison to rates of deposition of settlable solids experienced in the central area of the region in the past. It is not clear what the physical or chemical characteristics of these particles

would be, but they would be deposited in sufficient numbers to be readily detectable on certain surfaces and possibly to result in some soiling or corrosion.

Section 5.2.8 Social and Economic Characteristics

Effect on Boston Edison Rates

(104) The analysis seems inadequate with respect to the probable impact of the project on Edison rates. In times when utilities are experiencing a stabilization or even reduction in demand, a change of 1 to 2% is a very significant factor. Furthermore it may be appropriate to consider the impact of the construction of this plant upon projected Edison steam rates and in fact upon the economics of extension of the Edison system in the Mission Hill area.

Chapter 6 "All Measures Being Used to Minimize Environmental Damage"

(105) This agency is supportive of the concept of a total energy plant. The assumptions that underlie the statement of savings in energy consumption in comparison to alternative methods of providing energy to the hospital facilities in the area should be indicated in some detail. In addition the measures that have been taken, are planned, and could be taken, by those facilities served by the plant to reduce their energy consumption should be indicated.

(106) It is not clear whether the fuel oil storage tanks will constitute a single barrier between the oil and the surrounding soil and ground water or whether a double barrier with some dry compartmentation will be established. It is noted (page 6-2) with respect to reheating of the visible vapor plume, that additional provisions might be required during the cooler months. Those provisions should be specified.

Section 6.2 Construction Techniques

(107) In addition to the appropriate actions proposed under this section additional measures are required. They are suggested in earlier comments.

Section 6.3 Operation

(108) Use of number 2 fuel oil cannot be depended upon to minimize SO_2 emissions since the allowable limits of sulfur in both fuels are identical. Some form of continuous incineration would be preferable to a batch-fed operation if feasible.

Chapter 7 "Alternatives to the Proposed Project and Their Probable Impact on the Environment"

(109) This section seems reasonably comprehensive and presents qualitative supporting the choice of the selected alternative. I believe, however, that the

serious alternatives, that is, purchase of steam and electricity from Boston Edison and/or joint ownership of a steam plant with Edison should be commented on by Edison.

(110) The possibility of oil shipment by pipeline to the facility, in conjunction with possible oil shipment by pipeline to the proposed Station Street facility of Boston Edison, should be examined. This would have the obvious advantages of reducing necessity for on-site storage and thus reducing construction impacts, and of eliminating the necessity for oil trucks servicing the facility on a continuous basis. While pipeline delivery to the MASCO project alone or to the Station Street facility alone might not be feasible, the feasibility of combined delivery should be examined.

CITY OF BOSTON CONSERVATION COMMISSION / ROOM 911 / CITY HALL / BOSTON, MASSACHUSETTS / 02201

June 20, 1975

Evelyn F. Murphy
Secretary of Environmental Affairs
Executive Office of Environmental Affairs
18 Tremont Street
Boston, Mass.

RE: MASCO Total Energy Plant

Dear Secretary Murphy:

I would like to offer the following comments relative to the Draft Environmental Impact Statement for the proposed MASCO Total Energy Plant.

(111) The EIS is unclear in its discussion of water quality with reference to the volumes and effects of cooling water discharges to the sanitary sewer system. The 500 gallons per day of sanitary sewerage appears to be based solely on that used for sanitation, and does not appear to include the amount of water additionally discharged as a result of boiler blowdown and cooling. Large volumes of water discharge through the sanitary sewers could cause increased overflows at combined sewer outfalls into the Muddy River. The effects of these potential overflows on the water quality of the Muddy River should be more thoroughly evaluated.

(112) The disposal of 25,000 cubic yards of excavated material is a problem whose effects and methods of minimizing harm should be examined in more detail, as well as measures to reduce suspended solids during dewatering activity during construction.

(113) Alternatives to the proposed project, including alternative sites as well alternative sources of energy and steam, do not seem to have been seriously considered. The alternative of using Edison energy, in particular, seems to have been too lightly dismissed.

(114) It seems to me that what is occurring in the submission of proposals and impact reports for this and other closely related Harvard and Medical Area projects, such as the Mission Park Housing and the MASCO Service Center, is that bits and pieces of a master plan for the institutional area are being presented, rather than the opportunity for comprehensive evaluation of impacts and

AUGUSTA H. BAILEY ANTHONY FORGIONE JOHN LAMIE ROBERT E. HOLLAND JOHN LEWIS SUSAN D. STRAIGH

alternatives for institutional facilities and land use. The lack of a comprehensive and coordinated review of the interrelated proposals is especially serious in evaluating the potential effects and pressures on the Olmsted Park System, which is adjacent to the proposed sites for the various projects. It is becoming clear that the plans for modernization and improvement of the medical institutional area call for making the frontage of the area along the Olmsted Park the service entrance and back door for the medical area, rather than positively relating to and complementing this unique urban resource. This overall result and direction of institutional expansion of the area should be considered in the evaluation of impacts and in these land use decisions.

Sincerely yours,

Alan Weinberg
Executive Secretary

BOSTON REDEVELOPMENT AUTHORITY City Hall / 1 City Hall Square / Boston, Massachusetts 02201 / Telephone (617) 722-4300

July 29, 1975

Mr. Daniel Pincus
Environmental Research & Technology, Inc.
696 Virginia Road
Concord, Massachusetts 01742

Re: Medical Area Total Energy Plant Environmental Impact Report - Public Hearings

Dear Mr. Pincus:

By means of this letter I am submitting to you, for inclusion in the Final Environmental Impact Report for the Medical Area Total Energy Plant, a summary of the three Public Hearings held to consider the environmental impacts of the proposed energy plant and to receive and respond to comments concerning the Draft Environmental Impact Report, together with summaries of questions and comments on environmental issues raised at these Hearings.

The first Public Hearing was scheduled for June 4, 1975, and was held at Vanderbelt Hall of the Harvard Medical School. Approximately 150 persons, primarily residents of the Mission Hill area, attended. Due to continued disruption by several persons in attendance, the Hearing was not allowed to proceed in an orderly fashion and no comments on environmental issues were received.

The second Public Hearing was held at the Mission Hill American Legion Post 327 on July 9, 1975, and was attended by some 170 persons (see Attachment #1 for the Agenda). Following a description and background of the energy plant and a summary of the environmental impacts, prepared statements and comments were received from Rep. Kevin Fitzgerald, nine residents of the Mission Hill area, and a representative of Boston Edison. Six of the residents raised issues of environmental and other concerns respecting the proposed plant and three spoke briefly in favor of the plant; the Boston Edison representative presented a summary of their written comments on the Draft Environmental Impact Report, previously submitted to the Authority and the Executive Office of Environmental Affairs. The Hearing ended with several questions from the audience. A summary of the environmental issues and comments raised at this Hearing is included as Attachment #2.

The third Public Hearing was also held at the Mission Hill American Legion Post 327, on July 28, 1975. (See Attachment #3 for Agenda). This Hearing involved primarily responses to the questions and comments raised at the July 9 Hearing and responses to several additional questions from the audience during the course of the Hearing. In addition, prepared statements were offered by two Mission Hill residents. No new issues of environmental concern were raised at this Hearing; rather questions were in the nature of clarifications of the responses or of issues previously raised. Questions raised on environmental issues concerned primarily noise impacts, reduction of truck traffic in the area, the impact of air intake, plant operation and heat generation/usage, need for site monitoring of ambient air quality, justification for the provision for equipment expansion, alternatives to the proposed plant, and cumulative traffic impacts and circulation planning.

The issues of environmental concern raised at these Public Hearings should be responded to in the Final Environmental Impact Statement. Since most of these issues were also raised in the written responses received on the Draft Report, responses may be made by reference where appropriate.

Should you have any further questions, please feel free to call me.

Sincerely,

Richard B. Mertens
Environmental Review Officer

Attachment #1

AGENDA

ENVIRONMENTAL IMPACT PUBLIC HEARING ON THE MEDICAL AREA TOTAL ENERGY PLANT

July 9, 1975

1. INTRODUCTION - Daniel Weldon, President, Mission Hill Planning Commission

2. Robert T. Kenney, Director, Boston Redevelopment Authority

3. Description and Background of the Medical Area Total Energy Plant
   - Rudman Ham (Medical Area Service Corporation)
   - Bruno D'Agostino (Benjamin Thompson and Associates)

4. Summary of Environmental Impacts - Daniel Pincus (Environmental Research and Technology, Inc.)

5. Prepared Statements and Comments
   (Please Sign Up on Sheet in Rear of Hall)

6. Questions from Audience

SUMMARY OF QUESTIONS AND COMMENTS ON ENVIRONMENTAL ISSUES RAISED AT THE JULY 9, 1975 PUBLIC HEARING ON THE DRAFT ENVIRONMENTAL IMPACT STATEMENT FOR THE PROPOSED MEDICAL AREA TOTAL ENERGY PLANT

(115) 1. What is the projected amount of oil that will be burned in the total energy plant?

(116) 2. What is the relationship of the proposed plant's capacity to insitutional expansion?

(117) 3. Will the proposed plant be reliable? What has been the experience and reliability of other similar total energy plants? What has been the reliability of the individual components in the proposed plant?

(118) 4. What impact will the proposed plant have on truck traffic in the area? Will carbon monoxide levels increase?

(119) 5. How does projected oil use affect the air quality levels presented in the Draft Environmental Impact Report?

(120) 6. What are the implications of the hospital's dependency on oil?

(121) 7. Describe the visual impact of the proposed plant.

(122) 8. Discuss the alternatives to the proposed energy plant.

(123) 9. What steps have been taken to evaluate the cumulative long-term traffic impacts of all the proposed projects in the area?

(124) 10. What effect will noise levels (during construction and plant operation) have on patients in the Mass. Mental Health Center and on residents of the Fredericka Old Age Home?

Attachment #3

AGENDA

PUBLIC HEARING ON THE DRAFT ENVIRONMENTAL IMPACT REPORT FOR THE PROPOSED MEDICAL AREA TOTAL ENERGY PLANT - JULY 28, 1975 - 7:30 P.M.

1. INTRODUCTION - Daniel Weldon, President, Mission Hill Planning Commission

2. Robert T. Kenney, Director, Boston Redevelopment Authority

3. Presentation of Responses to Questions and Comments Raised at the July 9, 1975 Public Hearing/on the Draft Environmental Impact Report (see attached)

   - Daniel S. Pincus, Environmental Research and Technology, Inc. and others

4. Prepared Statements and Comments

   (Please sign up on sheet in rear of Hall)

5. Questions from Audience

1. Appendix I has been added to this report to present the energy demands and fuel usage of the total energy plant for the year 1990. This appendix is based on the most recent survey of energy needs of the institutions, steam charts from the existing powerhouse and expected performance characteristics of the proposed plant. The Draft EIR was based on utility surveys conducted in 1973 and the present and projected energy needs and fuel usage have changed since then.

2. Construction of the energy plant, Affiliated Hospitals Center and the Mission Park Housing Project will result in extending the area of influence of any single project. Residents, workers and patients in the area bounded by Francis Street, Brookline Avenue and Huntington Avenue will experience noise, dust and the negative visual aspects of construction from all sides. It is expected that truck traffic and related impacts could combine and create greater problems than could any one project by itself.

   Therefore, a construction review group is being planned made up of the separate developers and construction managers to review overall construction activities in this area. The review group will make recommendations for scheduling of trucks to avoid build-ups in truck movements; coordinate any interruptions of utilities; coordinate partial closings of streets; ensure passage for emergency vehicles; make recommendations for scheduling noisy operations, working hours, enforcement of parking regulations; cooperate in supplying security forces and traffic patrolmen; and work with the community to resolve complaints. Detailed plans for minimizing impacts cannot be made until construction schedules have been more firmly established.

3. The two main alternatives to the proposed project involve 1) Boston Edison supplying the electricity and the institutions producing steam and chilled water and 2) Boston Edison supplying steam and electricity and the institutions producing chilled water. It has been the intent of this report to show how the impacts of the

proposed project would change if the alternatives were used. It has not been possible to fully evaluate the impacts that would be produced by the actions that Boston Edison would have to take as its part of the alternatives because details of Boston Edison's actions have not been finalized.

The following Tables 8-1, 8-2 and 8-3 have been prepared to aid comparison of the proposed project and the alternatives. These tables show that most of the impacts associated with the proposed project would still occur because neither of the alternatives would eliminate construction on the site of the proposed project. Those facilities that would remain on the proposed site would include a cooling tower of the same size as that of the proposed project and a new building to house the generating equipment. The alternatives also result in a fuel oil burning facility within Mission Hill with a tall stack, oil storage and truck delivery of fuel.

The proposed incineration service would be included at the proposed site for the alternative of Boston Edison supplying electricity since steam generation equipment would be placed on the proposed site. That would allow the incinerators to use the tall stack that would be built, to have heat recovered, and to use the boilers as afterburners to eliminate odors. If Boston Edison were to supply both steam and electricity the removal of steam generation equipment from the proposed site would preclude incineration at the site.

Since the long term impact of this project and its alternatives that causes the greatest concern is the release of air contaminants and the resulting effect on ambient air quality, the air quality information presented in Tables 8-1, 8-2 and 8-3 has been represented in Table 8-4 for more clarity. Table 8-4 presents the fuel use, emissions and ambient concentrations resulting from each of the alternatives.

This table shows that the alternatives to the proposed project would result in a lower quantity of fuel used in Mission Hill for generating utilities for the institutions. The lower fuel use would produce lower contributions to ambient air quality. However, the contribution of contaminant concentrations from the proposed

TABLE 8-1

SUMMARY OF IMPACTS OF THE PROPOSED PROJECT

The proposed project is a facility to generate steam, electricity and chilled water and provide incineration service. A distribution tunnel to extend the existing distribution tunnel for the institution and a buried pipeline to Mission Park housing are also part of this project. The most prominent physical aspects of this project are cooling towers and a single 315-foot stack. The site is on the block bounded by Peabody, Binney and Francis Streets and Brookline Avenue. It contains buildings that have porential for residences and institutional use and is adjacent to medical institutions and a residential block.

Impacts of Construction	Construction activities and associated impacts are presented in Section 5.1 and are briefly summarized here for comparison to the alternatives in Table 8-2 and 8-3.
Air Quality	Fugitive dust will occur during demolition and excavation. Carbon monoxide concentrations in along Brookline avenue may increase if traffic congestion occurs and CO standards may be exceeded.
Hydrology	No significant impact on the Muddy River is expected.
Water Quality	No impact on the Muddy River is expected since no water will be pumped from the site to the storm sewers. Sanitary sewage load from workers is low.
Geology and Geohydrology	The project will be above the water table thus no dewatering will be required and structures in the area will not be undermined.
Noise	Noise from pile driving, demolition, excavation and other construction activities will be a nuisance and may interfere with normal communications in nearby buildings. Noise impacts will result along the distribution system.
Ecology	There will be no significant impact due to the limited wildlife and vegetation on the site.
Social and Economic Characteristics	The project will remove rental units from the site and convert an area into an institutional use. It will provide employment for about 200 people during peak construction and different jobs will be available throughout construction.
Land Use	Construction of the project will create localized negative impacts. It will not interfere with access to area land uses or interfere with community facilities and services. Truck traffic has the potential for causing increased traffic congestion. There will probably be compitition among workers for on street parking spaces.

TABLE 8-1 (Continued)

Cumulative Impacts

Noise and dust will extend over a larger area. Closing of parking lots and trucks in the area will create parking shortage and create increased traffic congestion.

Impacts of Operation

Operational activities and associated impacts are presented in Section 5.2 and are briefly summarized here for comparison to the alternatives in Tables 8-2 and 8-3.

Air Quality

Annual fuel use in 1990 will 27,076,680 gallons. Of this 11,784,340 gallons is burned in the diesels and 15,292,340 gallons is burned in the steam boilers.

Peak hourly and annual emissions will be as follows:

SO_2	580 lb/hr	2,124,390 lbs/yr
Particulates	60 lb/hr	234,780 lbs/yr
NO_2	1,172 lb/hr	5,630,460 lbs/yr

Peak concentrations on Parker Hill and the surrounding area are as follows:

	Surrounding Area	Parker Hill
SO_2 Concentrations		
3 hr	0.018 ppm	0.029 ppm
24 hr	0.007 ppm	0.011 ppm
Annual	0.0005 ppm	0.00025 ppm
Particulate Concentrations		
24 hr	1.89 $\mu g/m^3$	2.78 $\mu g/m^3$
Annual	0.13 $\mu g/m^3$	0.09 $\mu g/m^3$
NO_2 Concentrations		
Annual	0.0013 ppm	0.00048 ppm

Hydrology

There will be no significant impact.

Water Quality

There should be no significant impact on water quality. Annual water consumption will be 96,884,000 gal., and annual discharge will be 13,322,500 gal.

Geology and Geohydrology

There should be no significant impact.

Noise

The project will be controlled so as not to produce sound levels greater than 50 dBA at the site boundaries.

Ecology

There will be no significant impact.

TABLE 8-1 (Continued)

Social and Economic Characteristics	The project should not affect the social characteristics of the area. It does, however, allocate an area with potential for housing to energy generation. There will be no significant employment associated with plant operation. The project will make payments in lieu of taxes that exceed current taxes generated by the site.
Land Use	Allocation of the site will preclude its use for other purposes and the projects stack and cooling towers will have an aesthetic impact. The project will be served by 4580 trucks per year and current trash pickup from the institutions will be eliminated.

TABLE 8-2

IMPACTS OF ACTIVITIES ASSOCIATED WITH THE ALTERNATIVE OF
BOSTON EDISON SUPPLYING THE ELECTRICITY

	Actions Required by the Institutions	Actions Required by Boston Edison
	A facility would be required to generate steam and chilled water and to provide incinceration service. The same distribution system as that associated with the proposed project. The cooling tower and stack height will be the same as that of the proposed project.	A step down transformer station would be required along with a distribution system to the transformer station and from the station to the distribution system required by the institutions.
	The site would be the same as that of the proposed project, and would be fully utilized for institutional purposes.	The site is along Colburn Street and consists of a vacant lot at the base of Parker Hill. It is isolated from Huntington Avenue by a row of apartment houses.
Impacts of Construction	Construction activities would be nearly the same as the proposed project.	The degree of construction activities of the transformer station has not been defined therefore impacts cannot be assessed. Anticipated impacts are discussed whenever possible.
Air Quality	The impacts would be similar to those of the proposed project.	There would be some fugitive dust during excavation but none from demolition since none will be required. The need for blasting is not known. Trucks entering and leaving the site should not cause traffic tie-ups and thus should not significantly affect CO levels.
Hydrology	The impacts would be similar to those of the proposed project.	This site is remote from the Muddy River and should not affect its flows. It is not expected that groundwater would have to be pumped to the storm sewers.
Water Quality	The impacts would be similar to those of the proposed project.	There should be no impact on water quality since it is expected that no water will be pumped to the Muddy River. The sanitary load from workers would be low.
Geology and Geohydrology	The impacts would be similar to those of the proposed project.	It is expected that the facility would be above the water table and therefore there should be no impact on geology or geohydrology.
Noise	The impacts would be similar to those of the proposed project.	The extent of construction activities such as pile driving or blastings is not known. It is expected that all activities would comply with noise regulations of of the Boston Air Pollution Control Commission. Construction noise would be a nuisance to the residents of the nearby apartments.
Ecology	The impacts would be similar to those of the proposed project.	It is expected that there would be no significant impact on vegetation or wildlife because of the condition of the site.

TABLE 8-2 (Continued)

Social and Economic Characteristics	The impacts would be similar to those of the proposed project.	There should be a negligible social impact. Construction will create additional jobs, however, the number is not known.
Land Use	The impacts would be similar to those of the proposed project.	There should be no impact on land use because the site is currently vacant. No other plans for use of the land are known. Construction activities would create localized negative impacts but no interference with land uses or community services or facilities should occur.
Transportation	The impacts would be similar to those of the proposed project.	Trucks are not expected to create traffic congestion since there are two entrances to the site. There also appears to be enough parking area for workers and staging of materials.
Cumulative Impacts	The impacts would be similar to those of the proposed project.	Construction on Colburn Street may have an impact when combined with trucks serving the AHC and Mission Park Housing project.
Air Quality	Impacts of Operation It is estimated that annual fuel use would be 18,229,200 gallons burned in the boilers. Estimates of peak hourly and annual emissions are as follows: SO_2 458 lb/hr 1,434,290 lb/yr Particulates 48 lb/hr 170,630 lb/yr NO_2 255 lb/hr 802,900 lb/yr (These emissions include operation of incinerations) Estimates of peak concentrations on Parker Hill and the surrounding area should be as follows: Surrounding Area / Parker Hill SO_2 Concentrations 3 hr 0.014 ppm 0.023 ppm 24 hr 0.005 ppm 0.009 ppm Annual 0.0003 ppm 0.00017 ppm Particulate Concentrations 24 hr 1.51 $\mu g/m^3$ 2.22 $\mu g/m^3$ Annual 0.09 $\mu g/m^3$ 0.07 $\mu g/m^3$ NO_2 Concentrations Annual 0.0002 ppm 0.00007 ppm	Estimates of fuel use are 14,632,300 gallons if only oil is used and 10,242,600 gallons if 30% of electricity comes from nuclear generation. Estimates of annual emissions are as follows based on 30% of electricity produced by nuclear generation and the fuel burned in equipment complying with emission standards. SO_2 798,920 lb/yr Particulates 74,260 lb/yr NO_2 445,550 lb/yr It has not been practical to estimate the effect of these emissions on air quality since it is not known which power plant would produce the electricity used by the medical area institutions.

TABLE 8-2 (Continued)

Hydrology	The impacts would be similar to those of the proposed project.	It is expected that there would be no significant impact on hydrology.
Water Quality	The impacts would be similar to those of the proposed project.	The transformer station should not affect water quality. However, operation of fossil fueled and nuclear fueled power plants that will generate electricity for the medical area will have to reject heat from steam condensing and chemicals associated with treatment of boiler makeup water. The extent of these impacts have not been detailed.
Geology and Geohydrology	The impacts would be similar to those of the proposed project.	It is expected that there would be no significant impact.
Noise	The impacts would be similar to those of the proposed project.	It is expected that noise generation from the transformer station can be controlled so as not to exceed limits set by the Boston Air Pollution Control Commission. The impact caused by increased power generation has not been determined.
Ecology	The impacts would be similar to those of the proposed project.	The transformer station should have no significant impacts on ecology. The impact caused by increased power generation has not been determined.
Social and Economic Characteristics	The impacts would be similar to those of the proposed project. No determination has been made of the payments that would be made to the city.	The isolated site should not create significant social impacts. The project should not create a significant number of jobs. Taxes paid by the facility have not been determined.
Land Use	The impacts would be similar to those of the proposed project. Trucks to the site would be approximately 3,100 per year and current trash pickup from the institutions would be eliminated.	There should be no significant impact on land use because of the nature of the site. Truck traffic to the site should be small.
Other Impacts		Generation of 30% of the electricity by nuclear fuel can increase a source of radiation and affect the impacts associated with nuclear generation. The extent of these impacts has not been determined.

TABLE 8-3

ACTIVITIES AND IMPACTS ASSOCIATED WITH THE ALTERNATIVE OF BOSTON EDISON SUPPLYING STEAM AND ELECTRICITY

	Required by the Medical Area Institutions	Activities Required by Boston Edison for Steam Generation	Activities Required by Boston Edison for Electricity Generation
	A chilled water facility with the same cooling capacity as that of the proposed project would be necessary. A distribution system to the institutions would also be needed. The type of system has not been defined. The most prominent aspect of this project would be the cooling towers which would be the same size as those of the proposed project. There would not be a stack. It is possible that institutions could generate some of the chilled water in separate facilities thus reducing the size of the required facility. At this time the site of the existing power plant has been committed to another use and it is not available for the chilled water facility. The site of the proposed project would be used for the chilled water facility. Since combustion equipment would not be included as part of this project, incineration would not be included in this facility.	A steam plant would be built on Boston Edison's site on Station Street as shown in Figure 7.2-1. The plant would be oil fired and have similar steam generating and particulate collection equipment as that of the proposed project. It would have at least one stack 300 feet in height. Full capacity of this plant above that required by the medical area institutions has not been included in this table. The site contains approximately 65,000 square feet; it is vacant and zoned for industrial use. It is near the Mission Hill Housing Project. A steam distribution system would also be required to connect to the institutions' distribution system which would originate at the chilled water facility.	A step down transformer station would be required along with a distribution system to the transformer station and from the station to the institutions chilled water facility. These facilities are the same as would be required in the alternative of Boston Edison supplying electricity. The site is along Colburn Street as shown in Figure 7.2-1 and consists of a vacant lot at the base of Parker Hill. It is isolated from Huntington Avenue by a row of apartment houses.
Impacts of Construction		The degree of construction activities required for the steam plant has not been defined; therefore impacts cannot be fully assessed. Anticipated impacts are discussed wherever possible.	The degree of construction activities required for the steam plant has not been defined; therefore impacts cannot be fully assessed. Anticipated impacts are discussed wherever possible.
Air Quality	Fugitive dust will be created during demolition and excavation and installation of the distribution system. The excavation may be less than that required by the proposed project. Carbon monoxide levels could exceed air quality standards if traffic congestion occurs. The impacts would be similar to those of the proposed project.	Fugitive dust will be created during excavation. Since demolition would not be required a smaller amount of dust would be created than the proposed project. No information is available on which to assess carbon monoxide impact.	There would be some fugitive dust during excavation but none from demolition since none will be required. The need for blasting is not known. Trucks entering and leaving the site should not cause traffic tie-ups and thus should not significantly affect CO levels.

TABLE 8-3 (Continued)

Hydrology	The impacts would be similar to those of the proposed project.	It is not expected that there would be any significant impact because of remoteness from surface waters.	This site is remote from the Muddy river and should not affect its flows. It is not expected that groundwater would have to be pumped to the storm sewers.
Water Quality	The impacts would be similar to those of the proposed project.	It is not expected that there would be any significant impact on water quality.	There should be no impact on water quality since it is expected that no water will be pumped to the Muddy River. The sanitary load from workers would be low.
Geology and Geohydrology	The impacts would be similar to those of the proposed project.	No determination of impact can be made.	It is expected that the facility would be above the water table and therefore there should be no impact on geology or geohydrology.
Noise	It is expected that noise impacts would be reduced since pile driving to hold the sides of the excavation area would probably not be required. Construction noise would still be a localized nuisance.	Construction noise would be a localized nuisance. The need for pile driving or blasting is not known.	The extent of construction activities such as pile driving or blastings is not known. It is expected that all activities would comply with noise regulations of the Boston Air Pollution Control Commission. Construction noise would be a nuisance to the residents of the nearby apartments.
Ecology	The impact would be similar to that of the proposed project.	There should be no significant impact.	It is expected that there would be no significant impact on vegetation or wildlife because of the condition of the site.
Social and Economic Characteristics	The impact would be similar to that of the proposed project. A smaller building envelope could reduce time of construction and the duration of impacts.	No determination of impact could be made.	There should be negligible social impact. Construction will create additional jobs, however, the number is not known.
Land Use	The impacts would be similar to those of the proposed project.	There should be no significant impacts since the site is vacant. Installation of the steam distribution system could create significant disturbances.	There should be no impact on land use because the site is currently vacant. No other plans for use of the land are known. Construction activities would create localized negative impacts but no interference with land uses or community services or facilities should occur.
Cumulative Impacts	The impacts would be similar to those of the proposed facility.	It is not expected that cumulative impacts would occur except when the steam distribution system passed near the construction site of the AHC.	Construction on Colburn Street may have an impact when combined with trucks serving the AHC and Mission Park Housing project.

TABLE 8-3 (Continued)

Impacts of Operation			
Air Quality	The chilled water facility would not be a source of air contaminants. Incineration would not be included in this facility.	Estimates of fuel use is 19,140,650 gallons/year to provide steam for the medical area institutions. No estimate has been made of additional fuel that would be burned. Estimates of peak hourly and annual emissions are as follows: SO_2 480 lb/hr 1,492,970 lb/yr Particulates 45 lb/hr 138,770 lb/yr NO_2 267 lb/hr 832,620 lb/yr Estimates of peak concentrations on Parker Hill and the surrounding area are as follows: Surrounding Area / Parker Hill SO_2 Concentrations 3 hr 0.015 ppm 0.024 ppm 24 hr 0.005 ppm 0.009 ppm Annual 0.0004 ppm 0.00018 ppm Particulate Concentrations 24 hr 1.42 $\mu g/m^3$ 2.08 $\mu g/m^3$ Annual 0.08 $\mu g/m^3$ 0.05 $\mu g/m^3$ NO_2 Concentrations Annual 0.0002 ppm 0.00008 ppm	Estimates of fuel use are 14,632,300 gallons if only oil is used and 10,242,600 gallons if 30% of electricity comes from nuclear generation. Estimates of annual emissions are as follows based on 30% of electricity produced by nuclear generation and the fuel burned in equipment complying with emission standards. SO_2 798,920 lb/yr Particulates 74,260 lb/yr NO_2 445,550 lb/yr It has not been practical to estimate the effect of these emissions on air quality since it is not known which power plant would produce the electricity used by the medical area institutions.
Hydrology	The impacts would be similar of the proposed project.	No determination of impacts could be made.	It is expected that there would be no significant impact on hydrology.
Water Quality	The impacts would be similar to those of the proposed project. Water discharge would be approximately 10,512,000 gal/year and water use would be approximately 72,000,000 gal/yr.	It is expected that the plant would comply with all applicable water quality standards so that the impact would not be significant. If condensate return is not included annual use would be approximately 238,625,900 gallons. If condensate return is inclued annual water use would be about 23,863,000 gal.	The transformer station should not affect water quality. However, operation of fossil fueled and nuclear fueled power plants that will generate electricity for the medical area will have to reject heat from steam condensing and chemicals associated with treatment of boiler make-up water. The extent of these impacts have not been detailed.

TABLE 8-3 (Continued)

Geology and Geohydrology	The impacts would be similar to those of the proposed projects.	No determination of impacts could be made.	It is expected that there would be no significant impact.
Noise	The impacts would be similar to those of the proposed project since the cooling tower would remain the most significant noise generator. There would be no noise from oil delivery trucks since none would be required. Current noise levels generated by trash trucks would remain.	It is expected that the steam plant would be controlled so as not to exceed noise regulations of the Boston Air Pollution Control Commission.	It is expected that noise generation from the transformer station can be controlled so as not to exceed limits set by the Boston Air Pollution Control Commission. The impact caused by increased power generation has not been determined.
Ecology	The impacts would be similar to those of the proposed project.	It is not expected that any significant impacts would be produced.	The transformer station should have no significant impacts on ecology. The impact caused by increased power generation has not been determined.
Social and Economic Characteristics	The impacts would be similar to those of the proposed project since a similar cooling tower would be required at the site of the proposed project and the site would still be used by the institutions. There would be less objections to the facility since there would be no trucks required for normal operations and no stack. Employment would be minimal. No determination has been made of payments to the city.	It is expected that a 300-foot stack at this site would cause the same if not more concern than a stack at the proposed site. This stack would be in closer proximity to the Mission Church. The concern raised by oil truck delivery to this site could not be determined. No determination has been made of taxes that this facility would generate.	The isolated site should not create significant social impacts. The project should not create a significant number of jobs. Taxes paid by the facility have not been determined.
Land Use	Current trash pickup for the institutions would continue and no oil delivery trucks would travel through the institutional area. Other impacts would be similar to those of the proposed project.	It is not expected that use of this site would create significant conflicts with adjacent land uses. Oil trucks delivering oil for steam generation for the medical institutions would be approximately 3190 per year. No determination could be made of additional trucks supplying fuel for extra capacity for Edison.	There sould be no significant impact on land use because of the nature of the site. Truck traffic to the site should be small.
Other Impacts			Generation of 30% of the electricity by nuclear fuel can increase a source of radiation and affect the impacts associated with nuclear generation. The extent of these impacts has not been determined.

TABLE 8-4

COMPARISON OF THE AIR QUALITY EFFECTS OF THE PROPOSED PROJECT AND THE ALTERNATIVES

	Proposed Project	Alternative of Boston Edison Supplying Electricity	Alternative of Boston Edison Supplying Steam and Electricity
Fuel use in the Mission Hill Area	27,076,680 gal/yr	18,229,200 gal/yr	19,140,650 gal/yr
Total Fuel Use	27,076,680 gal/yr	28,471,800 gal/yr	29,383,250 gal/yr
Annual Contaminant Emissions in the Mission Hill Area			
SO_2	2,124,390 lb/yr	1,434,290 lb/yr	1,492,970 lb/yr
Particulates	234,780 lb/yr	170,630 lb/yr	138,770 lb/yr
NO_2	5,630,460 lb/yr	802,900 lb/yr	832,620 lb/yr
Peak Hourly Contaminant Emissions in the Mission Hill Area			
SO_2	580 lb/hr	458 lb/hr	480 lb/hr
Particulates	60 lb/hr	48 lb/hr	45 lb/hr
NO_2	1,172 lb/hr	257 lb/hr	267 lb/hr

TABLE 8-4 (Continued)

Contaminant Concentrations Due to Emissions in the Mission Hill Area			
On Parker Hill			
SO_2			
3 hr (0.5 ppm)	0.029 ppm	0.023 ppm	0.024 ppm
24 hr (0.14 ppm)	0.011 ppm	0.009 ppm	0.009 ppm
Annual (0.03 ppm)	0.00025 ppm	0.00017 ppm	0.00018 ppm
Particulates			
24 hr (150 $\mu g/m^3$)	2.78 $\mu g/m^3$	2.22 $\mu g/m^3$	2.08 $\mu g/m^3$
Annual (60 $\mu g/m^3$)	0.09 $\mu g/m^3$	0.07 $\mu g/m^3$	0.05 $\mu g/m^3$
NO_2			
Annual (0.05 ppm)	0.00048 ppm	0.00007 ppm	0.00008 ppm
On the Surrounding Area			
SO_2			
3 hr (0.5 ppm)	0.018 ppm	0.014 ppm	0.015 ppm
24 hr (0.14 ppm)	0.007 ppm	0.005 ppm	0.005 ppm
Annual (0.03 ppm)	0.0005 ppm	0.0003 ppm	0.0004 ppm
Particulates			
24 hr (150 $\mu g/m^3$)	1.89 $\mu g/m^3$	1.51 $\mu g/m^3$	1.42 $\mu g/m^3$
Annual (60 $\mu g/m^3$)	0.13 $\mu g/m^3$	0.09 $\mu g/m^3$	0.08 $\mu g/m^3$
NO_2			
Annual (0.05 ppm)	0.0013 ppm	0.0002 ppm	0.0002 ppm

TABLE 8-4 (Continued)

NOTES:

The total fuel uses for the alternatives include estimates of the electricity to be generated by Boston Edison at power plants away from Mission Hill based on 30% of the electricity needed being generated by nuclear fuel and the rest by fossil fuel.

Emissions and resulting concentrations from the proposed project and the alternative of Boston Edison supplying electricity include operation of the incineration equipment at the proposed site. This incineration would not be included in the alternative of Boston Edison supplying steam and electricity.

The fuel use and resulting concentrations of the alternative of Boston Edison supplying steam and electricity do not include fuel that Edison would burn at the Station steam plant for its own customers.

project and the alternatives would not be significantly different from one another. This can best be seen by comparison of the percentages of the air quality standards contributed by the proposed project and the alternatives in Table 8-5.

The acceptability of the proposed project and its alternatives have been considered in comparison to current air quality levels. As discussed in Section 4.1 of this report, SO_2 levels are below primary and secondary air quality levels with maximum measured daily and annual concentrations of 0.041 ppm and 0.012 ppm, respectively. The addition of the concentrations contributed from the proposed project or the alternatives would result in concentrations not greater than 0.052 ppm and 0.0125 ppm which are below the daily and annual air quality standards of 0.14 ppm and 0.03 ppm. Annual ambient nitrogen oxide levels (measured as NO_2) have not been fully defined because the validity of collected monitoring data is questionable. The low ambient concentrations that would be contributed from the proposed project or the alternatives should not be a major factor in allowing NO_2 air quality standards to be attained.

There is concern, however, about particulate levels in the Boston and surrounding areas. Current air quality data indicates that particulate levels exceed primary and secondary air quality standards. Therefore, the Secretary of the Executive Office of Environmental Affairs is committed to having a plan developed by December 31, 1975 which will attain and maintain the air quality standards. The primary standards are to be met as soon as possible and the secondary standards are to be met by December 31, 1978. (Particulates are contaminants of particular concern.) The control plan will be for the Metropolitan Boston Intrastate Air Quality Control Region (MBIAQCR) which includes Boston and 102 cities and towns contiguous to Boston.

Even though particulate monitors within the MBIAQCR have shown air quality levels in excess of the air quality standards the results are questionable. The high levels of particulates were recorded in trailer monitoring stations which may be greatly influenced by dust and dirt recirculated by passing vehicles. Elevated monitors have shown that air quality levels are not being

TABLE 8-5

PERCENTAGE OF THE AIR QUALITY STANDARDS CONTRIBUTED BY THE PROPOSED PROJECT AND THE ALTERNATIVES

Contaminant Concentration	Percent of Air Quality Standards: Proposed Project	Alternative of Boston Edison Supplying Electricity	Alternative of Boston Edison Supplying Steam and Electricity
On Parker Hill			
SO_2			
3 hr	5.8%	4.6%	4.8%
24 hr	7.9%	6.4%	6.4%
Annual	0.8%	0.6%	0.6%
Particulates			
24 hr	1.9%	1.5%	1.4%
Annual	0.2%	0.1%	0.1%
NO_2			
Annual	1.0%	0.1%	0.2%
On Surrounding Area			
SO_2			
3 hr	3.6%	2.8%	2.8%
24 hr	5.0%	3.6%	3.6%
Annual	1.0%	0.6%	0.8%
Particulates			
24 hr	1.3%	1.0%	0.9%
Annual	0.2%	0.2%	0.1%
NO_2			
Annual	2.6%	0.4%	0.4%

exceeded. The monitor on top of the Brookline High School which is probably most representative of air quality in the project and surrounding areas has recorded a maximum 24-hour particulate level of 102 $\mu g/m^3$. The addition of particulate concentrations from the proposed project or alternatives to that measured value would result in concentrations not greater than 104.8 $\mu g/m^3$ which is below the air quality standard of 150 $\mu g/m^3$.

In order to show the overall effect on air quality of the proposed project and alternatives, the change in particulate levels due to termination of the existing powerhouse on Blackfan Street has been estimated. This is shown in Table 8-6. The net effect of the proposed power plant on particulate concentrations on Parker Hill is an increase of 0.34 $\mu g/m^3$. That net increase is less than 0.3% of the 150 $\mu g/m^3$ 24-hour particulate concentration standard. At points surrounding Parker Hill the proposed project and the alternatives represent an improvement in particulate air quality levels.

The possibility of using coal in the proposed facility as an alternative fuel instead of oil has been considered. However its use has been precluded because of shipping, storing and handling problems. Coal has a heating value, Btu/lb, that is approximately 65% of that of oil. Thus the weight of coal required in the energy plant about 1.5 times the weight of oil. Storage area and number of trucks needed would also be about 1.5 times that required for oil. The higher ash and sulfur content of coal would require more extensive means of controlling the emissions of SO_2 and particulates and each control system would be another source of impacts. Coal conveying systems would also be needed to move the coal to coal crushers before going to the burners. This equipment is an extra source of dust and noise.

It should also be recognized that the proposed diesel generators cannot burn coal and thus two fuel systems will be required.

Oil unavailability has not been considered a major problem since large generating stations which are equipped for coal operation could switch from oil to coal, if variances would be granted, thus making more oil available for other uses. The recent regulations that allow major utilities in Massachusetts to burn higher sulfur oil will also make more low sulfur oil available.

TABLE 8-6

OVERALL EFFECT ON AMBIENT LEVELS OF PARTICULATES RESULTING FROM TERMINATION OF THE EXISTING POWERHOUSE AND CONSTRUCTION OF THE PROPOSED PROJECT OR THE ALTERNATIVES

	Parker Hill	Surrounding Area
Current 24-hour particulate concentration that would be avoided by termination of the existing power plant	-2.44 $\mu g/m^3$	-2.13 $\mu g/m^3$
24 hour concentration contributed from the proposed project	2.78 $\mu g/m^3$	1.89 $\mu g/m^3$
Net Effect	+0.34 $\mu g/m^3$	-0.24 $\mu g/m^3$
24-hour concentration contributed from the alternative of Boston Edison supplying electricity	2.22 $\mu g/m^3$	1.51 $\mu g/m^3$
Net Effect	-0.22 $\mu g/m^3$	-0.62 $\mu g/m^3$
24-hour concentration contributed from the alternative of Boston Edison supplying steam and electricity	2.08 $\mu g/m^3$	1.42 $\mu g/m^3$
Net Effect	-0.36 $\mu g/m^3$	-0.71 $\mu g/m^3$

Note: The 24-hour concentrations are presented here since there is only a 24-hour secondary air quality standard, 150 $\mu g/m^3$. The annual secondary concentration of 60 $\mu g/m^3$ is only a guide for achieving the 24-hour standard.

4. Air pollution impact of oil and ash removal trucks associated with the proposed project has not been quantified as discussed on page 5-60 because the frequency of truck visits is low especially when compared to traffic flow along Francis Street and Brookline Avenue. On an annual average, 14 oil trucks will be required per day and one ash removal truck per week. In comparison, Francis Street currently has a peak traffic volume of 600 vehicles per hour.

Noise impacts of trucks entering and leaving the site are presented on page 5-77 of this report.

The storage and collection of the solid waste in the manner proposed for this project produces no noise impact. Trash can be placed in the pneumatic conveying system at receptor points within the institutions which carries the trash to a collecting hopper within the energy plant. This eliminates the need for trash bins and trash trucks in the medical area.

5. The report includes sanitary, boiler blowdown and cooling tower blowdown in estimating water discharge. Sanitary wastewater will be about 500 gallons per day, 182,500 gallons per year. Average boiler blowdown will be about 15 gpm and peak cooling tower blowdown will be 150 gpm. Annual average discharge rate of boiler and cooling tower blowdown will be about 25 gpm. This is an annual discharge of 13,140,000 gallons. Total annual water consumption will be about 96,884,000 gal/yr. The annual consumption is based on maximum evaporation occurring continuously during cooling tower operation and is conservatively high. It also includes steam losses in distribution and in sterilization equipment.

6. This project has been designed with consideration of the Olmstead Park System. The building profile has been kept as low as possible and it has been set back from Brookline Avenue. The Brookline Avenue development has been aimed at continuing the masses of trees from Olmstead Park and the corner of Mass. Mental Health up Brookline Avenue.

7.-15. These questions are general in nature and are addressed under the more specific comments.

16. The Executive Office of Environmental Affairs reviewed a draft of the report that did not have the graphic quality of the report that was made public. The graphics in this report contain the proper quality.

17. Mission Hill is a heterogeneous community having a full range of family situations, professions and income levels. The Mission Park Housing Project retains this community characteristic by providing housing for various sizes of families of low, middle and high income levels. Open spaces, recreational facilities and the use of townhouses and low rise structures will help promote the feeling of a neighborhood. It also replaces a parking lot with housing. The energy plant itself will do nothing to promote community cohesion since it will allocate an area for power generation instead of housing.

18. The stack for the total energy plant is designed to be as simple and non-discriminate in the environment as possible. At the base, the stack is connected to the major lower elements of the power plant, thus achieving a more coherent appearance. The stack will probably be constructed of poured concrete tapering from 23 feet at the base to 14-1/2 feet at the top. The color will be light, to minimize contrast with the sky. There will be a ladder on the stack.

19. The percentage of the plant's output expected to be utilized by each user in 1990 will be as follows:

	Electricity	Steam	Chilled Water
Affiliated Hospitals Center	18.5%	14.4%	15.4%
Beth Israel Hospital	8.6%	15.1%	10.0%
Children's Hospital Medical Center	15.3%	13.2%	11.5%
Harvard University	31.3%	24.5%	37.3%
Joslin Diabetes Foundation	5.1%	5.1%	4.6%
Massachusetts College of Pharmacy	3.3%	0.6%	-
New England Deaconess Hospital	5.8%	11.0%	9.4%
Sidney Farber Cancer Center	12.1%	11.7%	11.8%
Mission Park Housing	-	4.4%	-
Total	100.0%	100.0%	100.0%

A further breakdown of steam and electricity uses is presented in Appendix I.

20. The energy plant has not been designed to be dependent on trash incineration. Instead, incineration service has been incorporated as a side benefit of this project since a distribution tunnel, tall stack and means of removing incineration odors will be available as part of the proposed project. Thus incorporation of incineration does not preclude plans for recycling. It should also be recognized that heat recovery from trash incineration is an important form of recycling.

21. The institutions do not have long-term plans for increased expansion. However, energy needs are expected to increase as new medical equipment requiring more enery is developed and as the population using hospital services increases. The energy plant will allow the institutions to meet future energy needs. Any expansion of hospitals or hospital facilities will be regulated by state laws and regulations.

22. The codes OA should be removed from Figure 3.5-3.

23. Activities of Children's Hospital which now take place on the site will be moved to other buildings of Children's Hospital in the project area. The exact location has not yet been established.

24. Roxbury Tenants of Harvard Inc. (RTH) consists of residents living in Harvard University owned housing in the area bounded by Brookline Avenue, Huntington Avenue and Francis Street. This organization filed for incorporation on January 27, 1972, "for the purpose of preserving and upgrading the residential neighborhood where its members live and to insure that relocation housing be built in the area for the people who were to be displaced by reason of the new buildings to be constructed for the Affiliated Hospital Complex." Over 200 people comprise the membership of RTH, husbands and wives as well as single people.

25. Environmental impact reports have been or are being prepared for major projects in the area. These are separate reports because the state agencies with responsibility for carrying out environmental reviews are different for each project. While the various projects can and have cooperated with one another, the state agencies must be able to work together to provide assistance on projects beyond their jurisdiction.

As part of overall planning, MASCO is sponsoring land development and traffic circulation plans for this area because of the new projects being developed.

26. Since MASCO will be operating remote parking lots it will be its responsibility to ensure that an adequate shuttle bus service is operating.

Enforcement of parking regulations in the project area and in Mission Hill by the police has not been adequate; this is a major complaint by the residents in the area. Any parking regulations that would ease parking problems and traffic congestion caused by cars trying to find parking spaces will have to be strictly enforced by the city traffic department to be effective.

27. The short term reduction of parking in the area is primarily a result of the use of the 1,680 space Vining Street lot for the Mission Park Housing Project and the use of the 230 space Peter Bent Brigham lot for the Affiliated Hospitals Center. Neither these nor other lot closings are a result of the energy plant project. It should be recognized that this reduction in parking

spaces is a short term effect of construction. By 1977, 895 spaces will be available for institutional use in the garage associated with the Mission Park Development, 190 spaces will be available in 1975 in the Sidney Farber Cancer Center Dana Building garage and 700 spaces are planned for 1979 in the proposed MASCO Service Center. During the period when parking in the project area will be reduced, MASCO has established remote lots to replace the spaces being lost by the closing of the Vining Street lot. Spaces are also being made available for construction workers. These are in commercial lots that have extra capacity in the Kenmore Square area and in the Church Park Garage on Westland Avenue. Space for parking is also being made available on land owned by the Turnpike Authority at Harcourt and Copley Square.

28. The use of a wrecking ball during demolition will cause the least noise impact to receptors near the site. This is because it is the quickest way to demolish a building, thus resulting in a shorter duration of noise impact. It also eliminates the noise produced by the continual raising and lowering of a clamshell. The building at the corner of Peabody and Binney Streets contains reinforced concrete floors which would necessitate the use of jackhammers which would be noisier if the wrecking ball were not used. The demolition contractor will be requested to work from the interior of the site to allow remaining walls to act as sound barriers.

This phase and all other construction activities will comply with noise regulations of the City of Boston in order to reduce impacts of noise. As of June 1, 1975, the limit allowable at the lot line of the Frederika Home is an L_{10} level of 80 dBA and a maximum noise level of 86 dBA. The closest hospital inpatients or elderly residents are in the Frederika Home which has part of its facility along Peabody Street. This part of the facility is about 75 feet from the building on the corner of Peabody and Binney Streets that will be demolished. The impact of the noise levels on residents of the Frederika Home is difficult to assess quantitatively. It is expected, however, that interior noise levels may

interfere with communication, annoyance will be felt and use of the Frederika backyard may be unpleasant.

29. The contractor will specify that the disposal subcontractor use a legally approved dumping area or a site that needs fill. State laws regulate the procedures for operating sanitary landfills and dumping permits will have to be obtained from the locality in which the landfill is located. These laws have been promulgated as a step in controlling environmental impacts. The Commonwealth of Massachusetts will not allow material to be burned on a barge within its territorial waters and the Environmental Protection Agency would require a full environmental review by the subcontractor if he planned any ocean dumping.

30. It is now planned that piles will only be driven along the Binney Street side of the site and for about 30 feet along Francis Street. Permission has been obtained from the Frederika Home to allow an extension of the excavation area so that a sloping side will be produced that will not require piles along Peabody Street. The piles that will be used are H beams that will hold the edge of the excavation area and are not required for foundational support. They will be placed in preaugered holes spaced six to ten feet apart and driven 10 to 20 feet. Lagging, wooden planks or steel sheets, will be bolted to the piles to hold the slope. Actual driving of the piles will take about two weeks.

Pile driving can produce sound levels of 100 dBA at a distance of 50 feet. This level of sound and the pounding nature will be a definite nuisance and will interfere with activities near the site. It will most directly affect residents of the Frederika Home and residents along Francis Street near the intersection of Francis and Binney Streets.

Efforts to reduce this impact have resulted in the use of the H beams instead of continuous sheeting, diesel driven hammers instead of steam and limiting the use of the piles to areas where it is necessary. Sonic or vibratory pile drivers which are very quiet cannot be used at the site because of the clay soil conditions.

31. A clearer map of the area showing the route of the distribution tunnel to the institutions is shown in Figure 3.5-6 on page 3-19. This tunnel will probably be installed underneath sidewalks. There will also be a pipeline buried under the roadway leading to Mission Park to service that development. While the routing has not been determined it will probably go along Francis Street and down Vining Street.

City noise regulations will restrict noise from the construction devices working on the tunnel from exceeding 86 dBA at a distance of 50 feet. This can be a noisy operation and can result in interior noise levels above those that occur normally. A 25 dBA attenuation in sound levels by single glazed windows would still result in noise levels in the sound level range of communication. This will be annoying and could interfere with people resting during the day in buildings bordering the distribution tunnel construction.

The construction engineers are examining the feasibility of digging a tunnel for the distribution system instead of the trench. If this is possible, no surface impacts would occur.

The distribution tunnel will require use of a jackhammer only at the beginning of a stretch of sidewalk. A backhoe can then lift the rest of the sidewalk. As the cut is made, the sides will be shored with lumber which will extend above the excavated area and will prevent someone from falling into the trench.

The pipeline to Mission Park will require a paving cutter and a backhoe; no jackhammers will be used. Excavation will be to a depth of 4 to 10 feet. These activities will be quieter than those associated with the distribution tunnel since it will use less equipment and will persist for a shorter period of time. It will be beside the Mass. Mental Hospital for about two weeks and will produce increased interior noise levels which may cause activities that take place in the hospital nearest the work area to be relocated. For security, the trench will be covered each night with steel plates or wood planks.

32. Because of the number of projects in construction and proposed, efforts are being made to have the representatives of the

various projects cooperate to minimize environmental impacts. No detailed plans have been prepared since detailed construction schedules have not been established. This construction review group will make recommendations for scheduling truck movements in order to avoid traffic tie ups which produce increased levels of carbon monoxide. Traffic patrolmen will be used to direct traffic. This has proven effective at other construction sites.

The closing of the Vining Street parking lot, as part of the Mission Park Project, will reduce peak hour traffic volumes in the area as shown on page 4-103. This will alleviate some of the potential for a carbon monoxide problem.

The Department of Environmental Quality Engineering, Bureau of Air Quality Control, will measure carbon monoxide levels if complaints are received.

33. The cumulative effect of significant sources of on-site noise are presented on page 5-18. Cumulative impact of noise levels from other construction projects is not arithmetically additive. If noise from another construction site were the same as from this site, the result would be a 3 dBA increase. That level increase is not normally detected by a human ear. If noise at another site were louder, that level would predominate and noise from construction activities at this site would not be noticed.

34. Figure 3.3-1 on page 3-5 shows the plan view of the project and surrounding land uses. The closest critical receptors to the site as seen from the Figure are the Frederika Home and the Children's Hospital. (The Good Samaritan Building of the Children's Hospital is not now used for medical care.)

Recently promulgated noise regulations for construction activities when applied to this project will result in no noise levels in excess of 86 dBA at the Frederika Home property line. The sound attenuation of the walls and windows of 25 dBA and the distance of the closest part of the building from the property line, about 75 feet, will result in interior noise levels of 60 dBA and less. Since studies have shown that levels of 70 dBA and above lengthen the time for someone to fall asleep, it is not expected that the interior noise level of 60 dBA will interfere with residents resting in the Home.

This does not include the pile driving for which there are no noise standards. This activity by its intermittent pounding will probably interfere with patients resting in the area.

It should be recognized that although this is an area of critical receptors extensive construction has been occurring. There has been no evidence from any of the past and ongoing work that the construction has produced detrimental effects.

35. The distribution tunnel will be shored with lumber that will stick up above the ground 4 to 8 feet. This provides a security boundary around the tunnel work area. It is not expected that a section greater than 50 feet will be open at one time.

The trench for the buried pipe to Mission Park Housing will be covered with steel plates or wood planks every night.

36. The disposal contractor will have the responsibility for finding a sanitary landfill that will take the different materials. Ocean dumping or open burning will not be allowed. Please also refer to response 29.

The potential shortage of landfill sites reemphasizes the side benefit of this project, incineration. This will reduce the waste that must be disposed of from the institutions by about 90% by volume, (80% by weight).

37. Excavated materials would be appropriate for cover material in a sanitary landfill.

38. The disposal of waste materials will be the responsibility of the disposal contractors. They must file for the appropriate permits and impact statements would have to be prepared if ocean dumping is considered.

39. A passageway for emergency vehicles will be maintained at all times. When the tunnel work must cross a road, it will be done either in stages so that one half of the road will be open for traffic, or the hole will be covered with steel plates so vehicles can travel over the area. Tunneling will be used if it is feasible to prevent any surface disturbance.

All street work must be cleared with the Boston Traffic Department so the City can verify that emergency ways are maintained.

40. Gas, water and electricity to the site may be temporarily interrupted as the services to the structures to be demolished are capped. It does not appear that any major utilities cross the site so site excavation should not cause service interruptions. Digging of the distribution tunnel could expect to encounter a large number of utility lines. Therefore, the depth of the tunnel is planned to be below most of the utilities. If utilities must be moved, interruption will occur. All work for the bypass will be done ahead of time so the interruption will be as short as possible. No interruption should last more than a few hours. People served by the utilities will be notified prior to an interruption.

41. No nighttime construction on the tunnel is planned. Longwood Avenue may be crossed by tunneling so there will be no surface disturbances.

42. The site has very limited staging area. Therefore, schedules are being prepared to have the materials brought in as they are needed. Since the construction managers of the projects in the area will cooperate it may be possible to use a staging area at the Mission Park Housing site.

43. No detailed plan can be established now for coordinating activities since start of construction for the projects has not been established. However, a construction review group is being planned to make certain that each project is aware of other projects' activities. This group will be able to recommend to the various projects steps it can take to avoid cumulative impacts. Please also refer to response 2 for more discussion of the construction review group.

44. The recently promulgated law will allow large facilities in the Boston core area to burn No. 6 oil with a sulfur content of 1.0% rather than 0.5%. Neither the particulate emission limit of 0.05 $lb/10^6$ Btu nor the sulfur content of No. 2 oil has been changed. Because of the size regulation only Mystic and L Street New Boston Stations in Boston will burn the higher sulfur fuel; the proposed energy plant does not meet the size requirement.

As part of the Department of Public Health's study of the sulfur regulations, an analysis was conducted by ERT for the Electric Generating Group of Massachusetts Utilities to assess the impact of selected contaminant sources in the MBAPCD, using residual fuel oils with various sulfur contents, and to determine the maximum allowable sulfur content that would maintain compliance with applicable ambient air quality standards. The selected sources had stack heights in excess of 100 feet, and included most of those residual oil users that will now be permitted to fire the 1.0% sulfur fuel. This study indicated that these sources could fire residual fuel oil with sulfur contents as high as 2% in the core municipalities and 2.6% in the remainder of the MBAPCD. The results and basis of this analysis are detailed in ERT Document No. 1219, An Assessment of the Air Quality Impact of Increased SO_2 and Particulate Emission from Stacks Taller than 100 Feet in the Commonwealth of Massachusetts, presented to the DPH in September, 1974.

45. The peak ground-level concentrations were shown to decrease when the load decreased to 50% of peak operation. It is thus expected that for this project highest concentrations occur at peak load.

46. In order to be conservative, atmospheric conditions were selected that would produce "worst case" concentrations. These included the highest concentrations from either an inversion with its base at the top of the plume rise or stack tip downwash (no plume rise) and neutral stability. Lower loads based on these conditions would not result in higher concentrations.

47. The proposed project has been designed for compliance with the National Ambient Air Quality Standards. These standards were promulgated to protect the health and general welafe of the population. They reflect consideration for particularly susceptible people which includes those with respiratory problems, cardiovascular disease, the very young and the very old. This was the determination of the National Academy of Science Coordinating Committee on Air Quality Studies in September 1974.

48. There are boiler plants for the Mass. Mental Hospital located along Fenwood Road and the New England Baptist Hospital on the top of Parker Hill. Neither of these sources should significantly affect ambient air quality in combination with the proposed project since they are low level sources.

49. There are no other fossil fuel utilization projects planned for this area that would make a significant contribution to air pollution. Traffic associated with the Affiliated Hospitals Center and Mission Park Housing will affect local concentration of carbon monoxide, hydrocarbons and nitrogen oxides.

50. Studies are being conducted at national levels on formation transport and effect of sulfates. This is an important area of research for which little information is now available. Cooling towers are not considered to be a source of acidic sulfates for which concern has risen.

51. The power plant project does not depend upon the diversion of water to the Quabbin Reservoir. The diversion was mentioned to indicate plans that have been considered for the reservoir.

52. Permits have been granted by the City of Boston Department of Public Works. No pressure tests have been requested by the City.

53. The developers of this project are committed to controlling the sound levels generated by the project so they will not exceed 50 dBA at the site boundary. This sound level is in compliance with noise regulations of the Boston Air Pollution Control Commission and will be quieter than noise levels that currently exist in the area.

54. Noise levels of 100 dBA at 100 feet could occur from steam release. If this steam release were part of a scheduled test, hospital personnel, patients and residents of the area would be notified and the impact would be about the same as an air raid siren. If this release were unscheduled, the sound would be startling and would waken people and raise concern of what had occurred. It should be recognized that unscheduled releases

should not occur since sudden drops in steam demand which would necessitate steam release are not expected.

55. Trash and oil trucks can generate the same amount of noise under acceleration, 86 dBA. However, the idling of trash trucks as they stop to make their pickups, the operation of the machinery to pick up the trash containers and compact trash may be more disturbing than noise produced during the passage of a truck.

Trash and fuel trucks can produce the same degree of traffic interference. However, since the oil trucks are longer - up to 55 feet in length and have a greater turning radius they would cause interference with traffic if a parked or waiting vehicle made turning difficult.

56. Since there are two incinerators, one will be on standby as the other operates. This allows continued incineration if maintenance is required on one. The design of the distribution tunnel will allow access to the pneumatic system if a blockage should occur. Panels along the pneumatic tubes will allow probes to be inserted to break up any blockage.

57. At this time, it is not expected that rainwater will have to be pumped from the site. This is because excavation will occur during the winter when occurrence of major rain storms should be low. Water will be allowed to stay on the site and evaporate instead of pumping it to the Muddy River. This will preclude carrying of silt into the Muddy River.

58. Trucks will not produce noise levels in excess of 86 dBA at 50 feet in order to be in compliance with regulations of the Boston Air Pollution Control Commission.

59. All available means of minimizing noise impacts during construction will be used. These include not allowing waiting trucks to idle; using well muffled equipment; erecting a plywood fence around the site; planning activities to limit the concurrent use of noisy equipment; bolting or welding structural steel instead of riveting; using backhoes and front end loaders instead of cranes whenever possible; pumping concrete instead of using a crane and bucket;

using soldier piles and lagging instead of continuous sheeting along Binney Street; cutting a slope along Peabody Street; and placing piles in preaugered holes to shorten driving distance. It will also be recommended to the unions that the start of construction should not be earlier than the standard time of 8:00 AM. Also, the entrance to the site will be where Peabody Street is now located with access from Brookline Avenue. This will keep trucks from traveling through the medical area and on Francis Street.

60. Consideration is being given to tunneling portions or all of the distribution system. If this is feasible, it would reduce or eliminate surface disturbances.

Noise from surface work can be reduced by proper muffling of all equipment so as not to exceed 86 dBA at 50 feet and reducing use of jackhammer and pavement breakers. A pavement breaker or jackhammer will only be needed at the start of opening of a sidewalk. Permits will be required from the Boston Air Pollution Control Commission for work that will generate noise.

61. The occurrence of storm overflows into the Muddy River is a function of the design of the Brookline sewer main and the various sewage flows that enter it from Boston. Brookline is now in the process of sealing overflows and creating retention basins to hold any overflows. The discharge from the energy plant, 165 gpm peak and 25 gpm average, should not by itself create a problem. However, full evaluation of the adequacy of the Brookline sewer main will have to be made by Brookline working in conjunction with Boston to determine total Boston flows into Brookline sewers. This coordination has not been to the complete satisfaction of Brookline. MASCO's involvement in resolving potential sewer overflows is limited to the extent of informing the City of Boston of its contribution to the city sewers.

62. The proposed plant has been designed so that a tie in with Boston Edison will not be necessary. In case of major emergency each hospital can use its own emergency diesel generator.

63. Please refer to the section Changes to the Project in the front of this report for a discussion of fuel savings of this project.

64. The allowable emission standards were used in estimating emissions from Boston Edison to provide a fair comparison with emissions of the proposed project which were also based on emission standards. Emissions from all combustion equipment may be lower. Increased emissions from Edison's use of diesels and their allowed use of higher sulfur content oil were also not incorporated in estimating the changes in overall emissions.

The environmental impacts of Boston Edison generating its electricity from nuclear plants is beyond the scope of this report. Boston Edison has prepared an environmental impact statement for the proposed 1180 Mw nuclear station Pilgrim II.

65. The alternatives have been presented in more detail in response 3.

66. Locating the project further from the area would shift the impacts from the medical area to the more remote site. However, since this is an urban area, it would have to be in a different type of area, lower density use, before the change in impacts would be significant. Keeping the plant within a one-mile radius would not create a substantial improvement and could create worse effects.

Remote siting beyond the area bounded by Huntington Avenue, the Riverway and the Fenway has not been seriously considered because of increased costs for a distribution tunnel and greater distribution losses for steam, condensate return and chilled water which would increase fuel use by about 10%. The maximum efficiencies of the energy plant can be realized only if it is located close to the users. In addition, the extra distance to the plant would make a pneumatic trash conveying system impractical.

67. The NO_x emission burden of the Boston Air Quality Control Region in 1972 has been estimated to be 337,106,000 lb/year by the Environmental Protection Agency. The proposed project will emit 5,630,460 lb/year which is about 1.7% of the 1972 emissions. If the diesels were replaced by gas turbines the project's NO_x emission would be approximately 1,177,800 lb/year which is 0.3% of the 1972 emission burden. Since no atmospheric diffusion models have been fully developed to simulate the photochemical reaction of oxides of

nitrogen, it is impossible to assess the air quality impact of differences in the emission burden.

68. Add-on devices for NO_x control such as catalytic converters and absorption on molecular sieves will be installed when they are available for commercial use.

69. The engineers, Paul L. Geiringer and Associates (PLGA), have recently resurveyed the individual cooperators as to present and future uses of energy and have examined the latest steam records from the existing power plant in order to reevaluate energy demands and consumption. This work has been done to update the work they had done in 1973, which indicated a fuel use of 21,453,400 gallons per year. Based on the recent results, fuel use could be 27,076,680 gallons in the year 1990. This oil will be used to supply energy to all the MASCO members, including the Joslin Diabetes Center, Sidney Farber Cancer Center's Dana Building, the Seeley G. Mudd Biochemical Laboratory and plant usages and distribution losses. It also reflects steam to be supplied to the Mission Park Housing. The fuel use is based on an annual steam generation of $1,909 \times 10^6$ lb and an annual electricity generation of 204,736,000 Kwh in 1990.

The fuel use does not include the fuel to operate the incinerator of about 100,000 gallons per year since no credit has been given for the heat recovered from incineration. The heat recovered will more than offset the fuel burned.

The steam load factor for this plant is about 37% based on diversified peak demand. This load factor is a function of the various types of users of steam which includes schools and hospitals and a housing development. The load factor for the energy plant has been based on actual experience of the institutions served by the existing power plant.

70. The delivery of fuel will be by trucks with 6,000 to 6,500 gallon capacities. These are standard sized trucks, which are used for deliveries to hospitals, schools, industries, and churches. The updated fuel usage shows that annual truck deliveries for No. 6 oil could reach 4,512 in 1990. Based on six-day weeks, the average daily number of fuel trucks is 14. This number may increase to 20

per day during the winter when fuel use is higher and decrease to 10 per day during the spring and fall when fuel use is least. Approximately 16 trucks per year will be required for delivery of No. 2 and lube oils.

The change in truck traffic associated with the energy plant is a result of an increased number of oil trucks in the area and a reduction of trash trucks. Currently there are about 7,000 trash and oil trucks in the area. When the energy plant is in operation, it will require about 4,580 trucks a year for oil delivery and ash removal and the trash trucks that serve the institutions will be eliminated. This results in a reduction of 2,420 trucks in the area.

The oil and ash removal trucks to the energy plant include 4,512 trucks for No. 6 oil, 16 trucks for No. 2 and lube oil and 52 trucks for ash removal. Current truck volume of 7,000 trucks consists of 1,800 oil trucks to the existing power plant and 5,200 trash trucks. The 5,200 trash trucks were estimated from a cost survey of waste disposal and the number of trucks supplied.

Ash trucks from the energy plant were estimated to be needed once a week based on the incineration of 14 tons of trash during a 17-hour day. A weight reduction of 80% would produce 20 tons of ash per week, which can be removed by one 30 cubic yard disposal truck per week.

71. No. 6 oil is an acceptable fuel for an inner city site since its low sulfur content, 0.5% by weight, and low ash content, less than 0.4% by weight, allows achievement of the applicable emission standards. Suitability of No. 6 oil in the diesels has been guaranteed by the diesel manufacturer. The only fuel treatment necessary will be centrifuging to remove sludge from the oil.

Air quality measurements from the Massachusetts Air Sampling Network (MASN) have been used to indicate air quality levels in the area. On-site monitors have not been used since the tall stack and atmospheric dispersion will produce peak concentrations 1,000 to 4,000 meters from the site.

The closest monitor to Mission Hill area is at the Brookline High School and is representative of concentrations coming from and

going into Mission Hill. This monitor has shown lower concentrations of contaminants than inner city monitors.

Sulfur dioxide measurements in Boston have been consistently below the standard. The maximum daily concentration was measured at Kenmore Square and was 30% of the standard. The maximum annual concentration was measured at Vassar Street in Cambridge and was 40% of the standard. Concentrations were lower at Brookline High School.

Particulate concentrations exceeded the secondary daily standard at Kenmore Square and were 68 percent of the standard at Brookline High School.

Even though manufacturers expect 90% collection efficiency, that number has not been used in calculating particulate emission. Instead, in recognition of emission regulations, the allowable level of emissions has been used. In order to meet this limit, the cyclones need only be 7% efficient even if unburned carbon emissions equal particulates formed from the fuel oil ash.

The impact on air quality in the area of the plant from the interactions between the incinerator and the steam boilers has not been discussed because the gases will not interact in the atmosphere. Incinerator flue gases are used as partial combustion air for the steam boilers as described in Section 3 of this report. This allows the steam boilers to act as afterburners for the incinerator flue gas while recovering the heat from that gas stream. A cyclone that follows the incinerators will control the amount of particulates that enter the boilers. The efficiency of this cyclone collecting flyash from the incinerator has been assumed to be only 50%.

72. Although the residents of the Frederika Home will be affected by the presence of the stack, the plant will result in a better backyard for the Home. It will be more secluded since the Peabody Street will be replaced with a pedestrian arcade. People further from the plant will not have any of the aesthetic advantages but will see the negative aspects. Since the stack is in an area of tall buildings, it will not stand out as greatly as if it were in an area of shorter buildings. The stack will be 14 1/2 feet or

less in diameter at the top and will be constructed of poured concrete. Extensive work has been conducted on the energy plant to minimize building profile, select materials compatible with the area, conceal fuel unloading and to set the building back from Brookline Avenue to allow for the planting of trees and a landscaped area for the bus stop.

Discussions with the FAA have indicated that no special lights or markings will be required on the stack since it is in an area of tall buildings and is in line with tall buildings and the airport.

Noise from sootblowing is not a concern since it will emanate from the top of the stack which is above area receptors.

73. The oil storage will be underground with no exterior access. This will prevent vandalism and keep curious children from being injured.

The storage and oil handling facilities will be evaluated by city and state regulatory agencies to make certain that public safety is not endangered.

74. The reliability of the diesels that are proposed for the total energy plant has been proven by past operating experience. As of 1973 513 of the proposed K series diesels have been installed in installations around the world using crude and residual oils. The proposed diesel can be operated on No. 6 oil down to 35% load at which point No. 2 oil is used. Hawker Siddeley, supplier of the diesels, has indicated an availability of 96% in a well maintained plant using heavy oil.

Dependency on oil is not a major concern for the following reasons: the existing power plant has had the highest priority for fuel during the past oil shortage because it serves hospitals; fuel deliveries have not been interrupted by strike even during the most recent one, three months ago; recent regulations that allow large facilities to burn higher sulfur oil will make more 0.5% sulfur oil available. It should be recognized that the energy plant is not entirely dependent upon No. 6 oil since it can burn almost any grade of oil. With minor modifications, the plant can burn natural gas, gasified coal, liquid or synthetic gas either alone or in combination with oil.

Finally, it should be recognized that the alternatives to this project, which would require Boston Edison to build a steam plant on its Station Street site in Mission Hill, would not eliminate the dependency of the hospitals on oil. Edison has indicated that the Station Street plant, that would serve the institutions, would burn No. 6 oil and would be served by truck.

The proposed project has been designed to be independent from Boston Edison. This has been reflected in the selection and sizing of equipment to ensure adequate electricity at all times.

The distribution system has been designed to increase plant reliability. It is a tunnel that allows internal maintenance instead of having to dig up the street as in the case of buried pipe. There are two transmission lines so power can be shifted to one while the other is being serviced.

75. Please refer to response 3 for a discussion of the alternatives.

76. A source of energy is a necessary part of institutional operation. The existing power house for example has been near institutions since its construction in 1904. While an energy plant is not truly compatible in an inner city location, it is well placed among the institutions it will serve. The area surrounding the proposed site will retain its institutional character and will be reinforced by the proposed Affiliated Hospitals Center.

77. It is difficult to predict how the cost savings of the individual cooperators of this project will be reflected in cost of health care. However, if costs of utilities increased by using the alternatives, the consumers of hospital services would have to absorb increased costs.

The impact of the distribution system is discussed in responses 31, 35, 39 and 40.

There are currently 488 installations in the United States that are total energy plants. These plants use diesel, gas turbine, gas engines or combinations of these to generate electricity and all have heat recovery equipment. They serve a wide range of facilities including schools, hospitals and industries. Data is not available for evaluating the impacts of these total energy plants.

Impacts of future expansion of the plant will be discussed if and when the expansion becomes necessary.

Cumulative construction impacts are discussed in responses 32, 33 and 43.

78. On site monitoring was not considered for this project since during operation, the ground level effects of the plant would not be noticed in the immediate site area but at distances ranging from 1,000 to 4,000 meters from the site. Therefore, measurements of SO_2 and particulates from the Massachusetts Air Sampling Network (MASN) have been used to indicate air quality in the area that would be influenced by the emissions from the energy plant. Please refer to response 71 for more details.

On site measurements for carbon monoxide and photochemical oxidants were not conducted because localized levels would not significantly change except during construction. Since the major construction activities for this project will take place for only one year, it was not felt that monitoring would be useful.

The measurements by MASN showed 115 violations of the 1-hour photochemical oxidant standard of 0.2 ppm in 1973 at Wellington Circle in Medford. Thirteen violations of the standard occurred at Kenmore Square from January to June 1974. These levels would have been higher in the absence of oxides of nitrogen. Since photochemical oxidants are of regional concern and their measurement is affected by local conditions, photochemical oxidants monitors are inappropriate in heavily trafficked areas. The 8-hour carbon monoxide standard of 9 ppm has been exceeded at Kenmore Square; the one-hour standard of 35 ppm has not.

79. In order to minimize contribution to ambient particulate concentrations, the total energy plant will have to comply with state emission regulations as determined by performance testing. Provisions will be made at the plant for this testing. The relation of this project and the alternatives to ambient air quality levels and attainment of particulate standards in particular are discussed as part of response 3.

80. The comment is correct. The Boston Traffic Control Plan is directed toward reduction in carbon monoxide and photochemical

oxidant emissions and not towards nitrogen oxides. It will, however, result in reducing NO_x emissions by reducing the number of vehicle miles traveled and thus reducing total vehicular emissions.

81. The estimation of carbon monoxide levels in the site area used in the Draft EIR is not a sophisticated approach. It does not take into account the effects of traffic congestion or the aerodynamic characteristics of the area. However, since this project is not a traffic generator except during construction, a more elaborate estimation or measurement procedure was not considered necessary.

82. It is correct that local conditions of traffic affect the determination of the regional level of photochemical oxidants. Thus, it is likely that regional levels may be higher than indicated by monitors located in heavily trafficked areas.

83. There are other techniques for determining the L_{90} noise level than that used in the noise study. However, special efforts were made in taking multiple readings, up to 10 in the absense of predominating noise sources, to establish background levels. Technical studies indicate that only 3 to 10 readings are necessary for determining the L_{90} level.

In addition to these single number background sound level measurements, 24 hour measurements were made at two sites as explained on page 4-47. These diurnal measurements provided more sophisticated definitions of nighttime and background noise levels.

Efforts were not made to make noise measurements with the existing power plant shut down since the continuous operation of the power plant is a source of noise that is part of the current background noise levels in the area.

84. The disposal of demolition debris is discussed in response 29.

Little amplification of fugitive dust control measures is possible because of the limited procedures available. Demolition from the inside of the site will allow remaining walls to limit the spread of dust released. Fog spraying with water will also be used to control dust. During excavation, front end loaders will be used instead of cranes to reduce loss of material in transfer to the

trucks. The excavated area will be ramped to allow trucks to be loaded close to the work area and to allow the sides of the excavated area to prevent the spread of dust. All truck paths will be graveled and/or covered with calcium chloride. The contractor will sweep the streets frequently and all loads of loose materials will be covered. The Boston Department of Public Works enforces the street cleaning and load covering regulations. The clay content of the soil will be a factor in lowering amounts of dust from this construction project.

85. Please refer to response 30 for a more complete discussion of the type, extent, duration and noise impact of pile driving.

Slurry wall construction is used for sites that have groundwater infiltration problems. It does not eliminate the use of piles to hold the sides of the excavation area as will be required at the proposed site.

86. All steel work will be assembled by bolting or welding. Of these methods welding is quieter since it does not require any impact devices. Riveting will not be used. Any spraying of insulation or paint will be done in an enclosed area. It is planned that all steel will be shipped already primed and any insulation or interior painting will be done after the exterior shell has been completed.

87. Hours of construction will be normal union working hours which are 8:00 to 4:30. Since it is possible that union members can vote for an earlier starting time, the 8:00 AM start of construction will be strongly recommended to the unions to avoid early morning disturbances.

88. The contractor will comply with all regulations of City of Boston during all phases of construction including street openings.

89. Please refer to response 84 which discusses the methods that will be used to control fugitive dust.

90. As indicated on pages 5-7, 8 and 9, carbon monoxide levels in the area could exceed the standards as a result of traffic congestion. Traffic patrolmen will be used to direct traffic to avoid

the congestion caused by truck traffic. Since the site is small, truck deliveries and movements will be planned by the contractor to prevent waiting trucks as a cost saving measure as well as to reduce impacts. This schedule has not been finalized at this time.

The construction review group, discussed in response 2, is being planned to coordinate construction activities including truck movements of the various projects in the area to avoid traffic congestion. This will also help reduce CO levels.

91. The comment is correct that competition for on street parking spaces near the site will probably occur during construction. Parking restrictions for residents only and incentives for workers to use the remote lots as presented in section 6.6 could eliminate that competition. In order to make parking restrictions effective, the Boston Traffic and Parking Department must actively enforce the parking regulations.

92. Present plans do not call for pumping water from the site. A heavy rainfall would delay construction until the site dried.

93. As indicated on page 5-13, the disposal of excavated material could produce problems. The contractor will make certain that the disposal subcontractor is aware of the problems associated with disposal and will specify that disposal be in a legally approved manner. No other information will be available until a subcontractor has been selected. This material would be acceptable for backfilling construction projects, as a sanitary landfill covering, and as fill for low areas as long as a better grade of soil is placed on top to support vegetation.

94. The comment is correct and as stated on page 5-77 steam release noises can exceed noise standards. However, a comparison between the proposed project and noise problems of Boston Edison is inappropriate. The steam relief valves of the energy plant are not designed for routine use since each operation of the valve requires maintenance work to reseat it. Because steam can bypass the back pressure turbine if there is a sudden drop in electrical load and because steam pressures are not expected to fluctuate rapidly, it is expected that the steam release valve will only be activated

during testing of that valve. There are no methods now available for reducing noise from this source.

95. In order to comply with the noise limitations recently adopted by the Boston Air Pollution Control Commission, the contractor will ensure that all equipment on the site is properly muffled and will obtain the necessary permits which regulate noise levels. Since most of the heavy construction equipment will be below grade, noise levels should be lower than those presented in this report. If noise levels become excessive due to multiple operations, the work can be rearranged to separate equipment or delay the use of some of the equipment. Equipment will not be allowed to idle on the site. It is expected that the Boston Air Pollution Control Commission will monitor noise levels during construction.

96. Please refer to response 29 and 36 for discussion of disposal of demolition and other solid wastes.

97. Section 6.6 presents recommendations for minimizing parking and traffic problems. Please also refer to response 26 for a discussion of shuttle bus service and need for enforcement of parking restrictions.

98. The requirements for incinerator siting and emission limitations have been recognized and all necessary approvals and permits will be obtained. It is also recognized that Table 5.2.2-1 on page 5-38 incorrectly stated that there are no particulate limits for the diesels. The proper limit is 0.05 $lb/10^6$ Btu. The correct emission limit has been used as stated on page 5-39 in calculating maximum allowable emissions from the diesels.

Boiler modifications to limit NO_x emissions such as flue gas recirculation should not be required because the steam boilers are oversized and because the combined cycle operation using the diesel exhaust results in lower NO_x emissions. If flue gas recirculation is used, it would not affect sulfur dioxide emission rates which are dependent upon sulfur content of the fuel. Emission rate of particulates could increase because of the change in the flame pattern.

A magnesium oxide additive will be used in the steam boilers to control acid soot. It will be added to the oil as it goes to the boilers in proportion to the vanadium content of the fuel. The MgO will react with the vanadium to prevent the catalytic formation of SO_3 and will react with SO_3 to form $MgSO_4$. This will increase the particulate loadings in the flue gas. The energy plant will still be in compliance with the state emission standards. All additives will be approved by the Department of Environmental Quality Engineering.

99. A reduction in load should not affect the rate of particulate emissions since excess air of between 15 to 20% should provide sufficient oxygen to prevent increased formation of unburned carbon. Furthermore, because there are multiple units, a reduction in load can be achieved by reducing load in some boilers while allowing the remaining boilers to stay at full load.

Gaussian plume dispersion has been applied to situations other than those on which it was originally based and it is currently an accepted tool for estimating contaminant concentrations. Modifications to the basic parameters presented in Turner's Workbook have been made to account for dispersion over an urban area. In order to maintain calculated concentrations conservatively high the air quality analysis used emissions associated with peak performance, and one hour, three hour and 24 hour concentrations used the worst case atmospheric conditions. This worst case condition was an inversion with its base just at the top of the plume rise which limits vertical dispersion.

100. Please refer to response 44 for a discussion of the recent fuel regulations.

The full air quality effect of Boston Edison constructing a steam plant at Station Street in addition to the proposed project has been considered to be beyond the scope of this report. At the time that Boston Edison formally proposes a steam station, it is expected that they would have to be responsible for considering the environmental impacts of their actions. At this time, the Station Street Steam Station would be an alternative to the steam production at proposed project instead of being an additional project.

101. This effect has been addressed on page 5-53 and updated in the section of this report entitled Changes in the Project. It has also been estimated that concentrations 40' above Parker Hill would be about 2% greater than that measured on the top of the hill. The effects of terrain on contaminant dispersion are presented in Appendix D.

102. Since there are no guidelines concerning concentrations at elevated surfaces, no quantitative determination could be made as to whether or not concentrations that would result would be excessive Since air intakes of the nearest tall building, the proposed Affiliated Hospitals Center are at a lower level, 6th floor, the highest concentrations calculated would not be brought into the building. It should be understood that the calculation assumed direct impingement of the plume on the buildings instead of the plume flowing around or over them. Results are thus conservatively high. It should also be recognized that a 15 foot extension is planned for the stack to further reduce the potential for interaction between buildings and the plume.

103. The solid material in the drift will consist of salts of the chemicals listed on page 5-59. These will include calcium, magnesium, potassium and sodium sulfates and chlorides and calcium carbonate and silica oxide. These are constituents commonly found in rainwater. Even though actual deposition will be less than estimated from the conservative method used in this report. The addition of settleable solids in the air may result in increased soiling. The degree of this soiling is expected to be low compared to background conditions, but the extent cannot be quantified with certainty.

104. As stated in the report, it is difficult to determine the effect on Boston Edison electric rates, especially considering possible rate restructuring, the rates at which Boston Edison must borrow money for construction, dividends to stockholders and the means of allocating construction costs required by the alternatives to the consumers.

The proposed plant should have no effect on Edison's steam rates since Edison does not now serve the medical area.

105. The proposed energy plant reduces fuel consumption principally because of heat recovery, higher boiler efficiency, lower distribution losses, recovery of condensate, and using exhaust gases as partial combustion air. As shown in Appendix I, the fuel savings from heat recovery is about 3,156,500 gallons per year. The boiler efficiency is about 3% higher using exhaust gases, distribution losses are only about 5%, the condensate will be returned to the boilers at a temperature of about 150°F. The lack of these factors could increase fuel use for steam production by about 8% in conventional plants.

In an effort to reduce energy consumption MASCO provides services to the institutions for reducing utility use through engineering analysis, training and upgrading operating staff, special investigations and studies, design review of new installations and preparation of system manuals. These activities were responsible for saving almost 1,400,000 gallons of oil in 1974 as compared to 1973 despite 11% more degree days in 1974 and several new facilities in operation.

106. The oil tank for the No. 6 oil will be of single wall reinforced concrete construction. The structural engineers have considered that double barrier or other types of construction would not be necessary. The more fluid No. 2 oil and lube oil will be contained within fiberglass tanks within a compartment of the concrete tank.

Steam will be used to generate hot water that can be passed through the heating coils in the upper section of the cooling tower for plume abatement if enough hot water is not available from the diesel engine jacket cooling water.

107. The use of other construction techniques to minimize environmental impacts such as the use of a slurry wall instead of pile driving are discussed in responses 30, 85 and 95.

108. The recent regulations which have allowed increased sulfur content for certain large facilities has not changed the allowable sulfur content of No. 2 oil. It must not exceed 0.3% sulfur.

The batch feed incinerator has been selected to allow full combustion of material. The sizes of each batch and frequency of introduction of new waste can be regulated to maintain a nearly

continuous operation. For the sizes of incinerators to be installed, 20 tons/day, this batch feed process would give better overall performance for waste incineration than continuous feed.

109. The comment period following publication of the Draft EIR has allowed Boston Edison to comment on the alternatives. They have done so and the Boston Redevelopment's summary of their comments are contained and addressed in this report. Please refer to response 3 for more discussion on the alternatives.

110. Current plans for the Station Street Steam Plant include delivery of oil by truck instead of by pipeline. Therefore, the possibility of a combined pipeline would not exist.

111. Response 5 clarifies the water discharge and consumption figures. Most of the consumption has been calculated as the result of continuous peak evaporation in the cooling tower.

All water discharges will go to the sanitary sewer which connects to the Brookline sewer main. Permits have been granted by the Boston Department of Public Works for use of the Boston sewer which connects to the Brookline sewer. The impact of this discharge on causing overflows is difficult to determine since Brookline does not have information on all discharges going to their sewer main. Boston must coordinate its activities better with Brookline. Brookline is working on its sewer system to prevent overflows and can design to accommodate the energy plant. This is also discussed in response 61.

112. The disposal of excavated material is addressed in response 29. No dewatering of groundwater is expected since the site will be above the water table. It is also not expected that rainwater will have to be pumped from the site since excavation and foundation work will be done in the winter. Water that does collect in the site can be allowed to evaporate.

113. Please refer to response 3 for more discussions on the alternatives.

114. Separate environmental reports for the three major projects in the area have been prepared because the different state agencies have had responsibility for the environmental assessment of each

projects. The institutions are aware of the need for overall planning and as a result have formed the Medical Area Service Corporation (MASCO) to provide institutional planning in this area of Boston. MASCO has sponsored an overall land use planning and traffic study from Charles Hilgenhurst Associates of Boston. These plans are being made available to the Boston Redevelopment Authority.

There has been extensive architectural work in the planning process so that the energy plant would not detract from Olmstead Park. The office building has been set back from Brookline Avenue at the corner of Francis Street to achieve a more open feeling and provide space for large trees. This arrangement has been aimed at continuing the masses of trees from olmstead Park and the corner of Mass. Mental Health up Brookline Avenue.

115. Total annual fuel oil use in 1990 is estimated to be 27,076,680 gallons. This is presented in more detail in Appendix I.

116. Please refer to response 21.

117. Please refer to responses 74 and 77.

118. During construction, carbon monoxide levels along Brookline Avenue at various times during the day could increase by 55% and could result in levels exceeding the standards. This would be a result of vehicles idling in a traffic tie-up caused by construction trucks entering and leaving the area.

The problem can be avoided by traffic control and cooperation between the various construction projects. Traffic patrolmen will be used to help trucks turn on to and off of Brookline Avenue and will enforce parking regulations near the projects that affect traffic flow.

Cooperation between projects can result in scheduling truck movements so that peak periods of truck activity of different projects do not coincide.

Carbon monoxide levels in the area will not increase as a result of this plant's operation because it is not a traffic generator as is a housing project or a garage. The associated closing of Peabody Street may improve traffic flow on Brookline Avenue, since cars would not turn across on-coming traffic to enter

the street. An improvement in traffic flow will reduce carbon monoxide concentrations. Wilbur Smith and Associates has been studying traffic circulation for the area and is making final recommendations to MASCO and the BRA for solutions to current overall area traffic problems.

119. The air quality levels resulting from the 1990 fuel use is discussed in the section Changes to the project in the front of this report.

120. Please refer to response 74.

121. Please refer to responses 18 and 114.

122. Please refer to response 3.

123. Please refer to response 114.

124. Please refer to responses 28, 30, 31, 33, 34, 54, and 70.

APPENDIX A

BOREHOLE AND PERMEABILITY DATA

FOR

MEDICAL AREA TOTAL ENERGY PLANT

FROM

GEOTECHNICAL ENGINEERS, INC.

WINCHESTER, MASSACHUSETTS

DATA TAKEN OCTOBER -NOVEMBER 1974

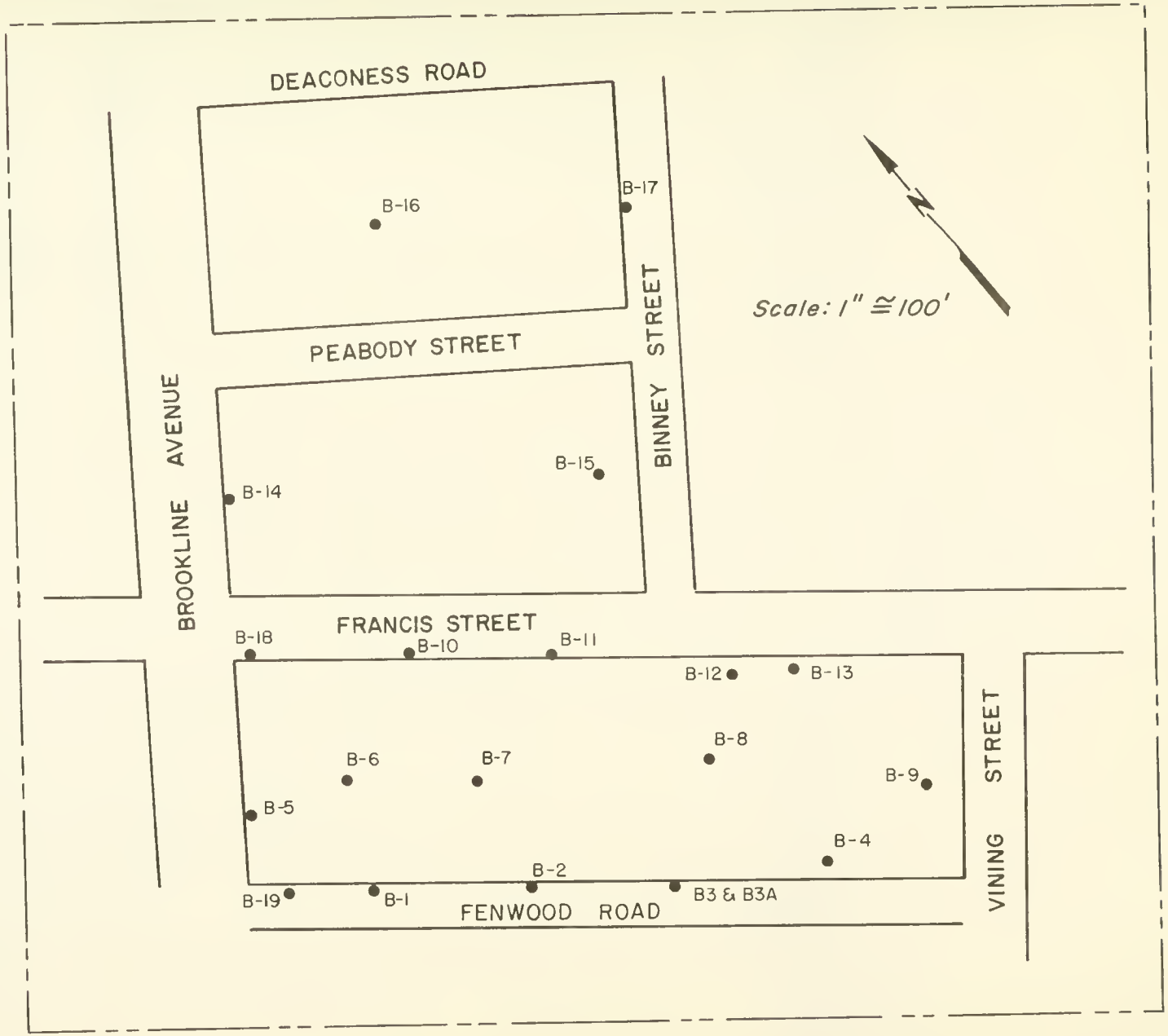


Figure A-1 Location of Boreholes

RESULTS OF FIELD PERMEABILITY TESTS
PERFORMED IN CASED HOLES
IN SAND LAYER

Boring No.	Nominal Casing Diameter in.	Test Elevation (BCB)	Soil Description	Casing Bumpout ft	Permeability $k \times 10^{-3}$ cm/sec
B-1	2.5	-30	Medium to fine sand, trace silt	0.5	8
B-2	4.0	-31	Fine sand, some silt	0.5	2
B-10	2.5	- 8	Sandy gravel	0	5
		-13	Sandy gravel	0	>> 1
		-23	Medium to fine sand, trace silt	1.0	>> 1
B-11	4.0	-13	Medium to fine sand, trace silt	0.5	> 1
		-18	Medium to fine sand, trace silt to silty	0.5	2
B-1[illegible]	4.0	-18	Medium to fine sand, trace silt	0.5	0.4
		-28	Coarse to fine sand, trace silt	0	30.0

Note: Additional tests were performed in these borings and also in Boring B-14, in which the flow of water out of the bottom of the casing was significantly slower than in the tests shown above, and consequently the permeability of the soil at those locations is smaller than those shown in this table. The values in this table represent the highest permeabilities encountered in the sand layer.

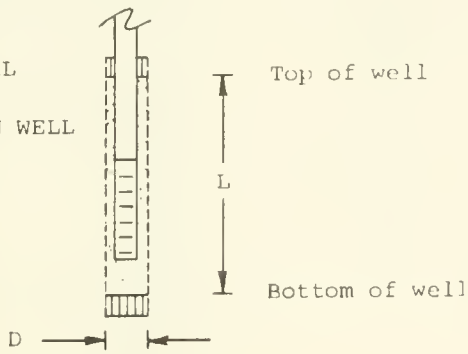
RESULTS OF FIELD PERMEABILITY TESTS
PERFORMED IN OBSERVATION WELLS
IN THE GLACIAL TILL

Observation Well No.	Boring No.	Elevation (BCB)		Location of Observation Well	Diameter D in.	Length L ft	Permeability $k \times 10^{-6}$ cm/sec
		Top of Wall	Bottom of Wall				
OW-1	B-4	-46.6	-70.4	In lower part of till layer extending into bedrock	4.5	7.8	3*
OW-2	B-12	-20.2	-27.2	In upper part of till layer	4.5	7.0	300
OW-3	B-2	-35.6	-51.3	In upper part of till layer	4.5	15.7	200
OW-4	B-11	-54.9	-71.0	In lower part of till layer extending into bedrock	4.5	11.3	4*
OW-5	B-19	-64.7	-73.7	In middle to upper part of till layer	4.5	9.0	100
OW-6	B-18	-40.4	-49.1	In upper part of till layer	4.5	8.7	100

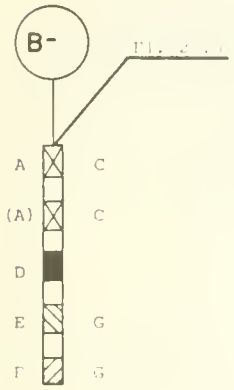
* Assumes no flow of water into bedrock

TYPICAL

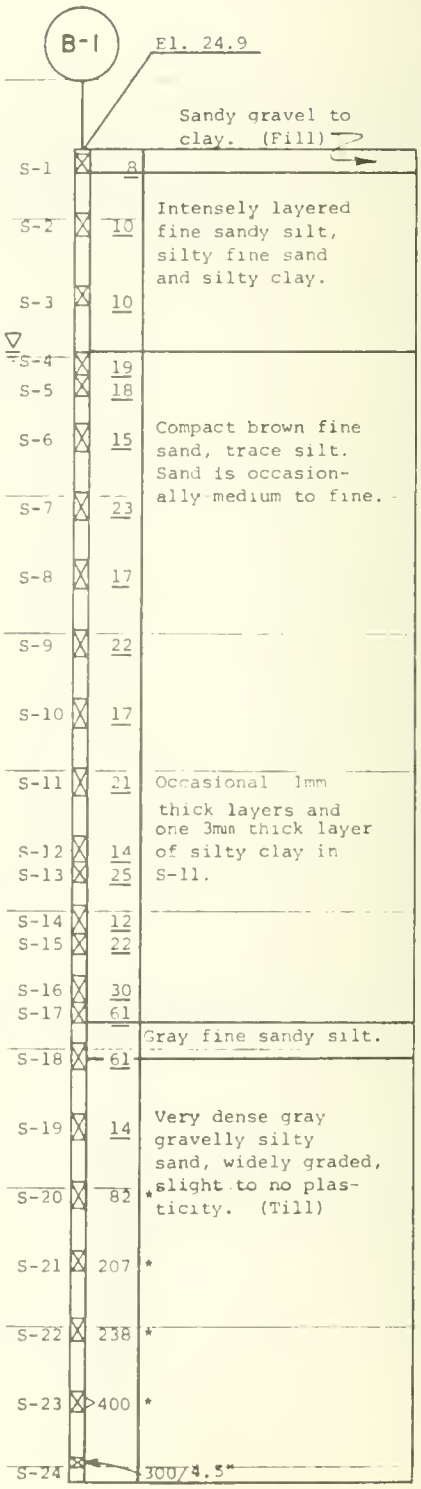
OBSERVATION WELL



LEGEND



B	Boring No.
El.	Elevation - Top of boring (BCB)
A	Sample No. - 2-in. OD Split Spoon Sample
(A)	Sample No. - 3-in. OD Split Spoon Sample
C	Number of blows/ft of 140-lb hammer falling 30 in. to drive sampler 1 ft (unless otherwise indicated)
C*	Number of blows/ft of 300-lb hammer falling 30 in. to drive sampler 1 ft
C**	Number of blows/ft of 440-lb hammer falling 30 in. to drive sampler 1 ft
D	Sample No., thin-walled tube sample
E	Core run number - till coring with double tube core barrel (2.2 in. ID)
F	Core run number - rock coring with double tube core barrel (2.2 in. ID)
G	Recovery in percent of length of core run
▽	Groundwater elevation in boring (see Note 1)
▼	Average groundwater elevation in observation well
OW	Observation Well No. (See Note 2)
H	Location of bentonite seal
J	Location of sand filter surrounding slotted PVC pipe



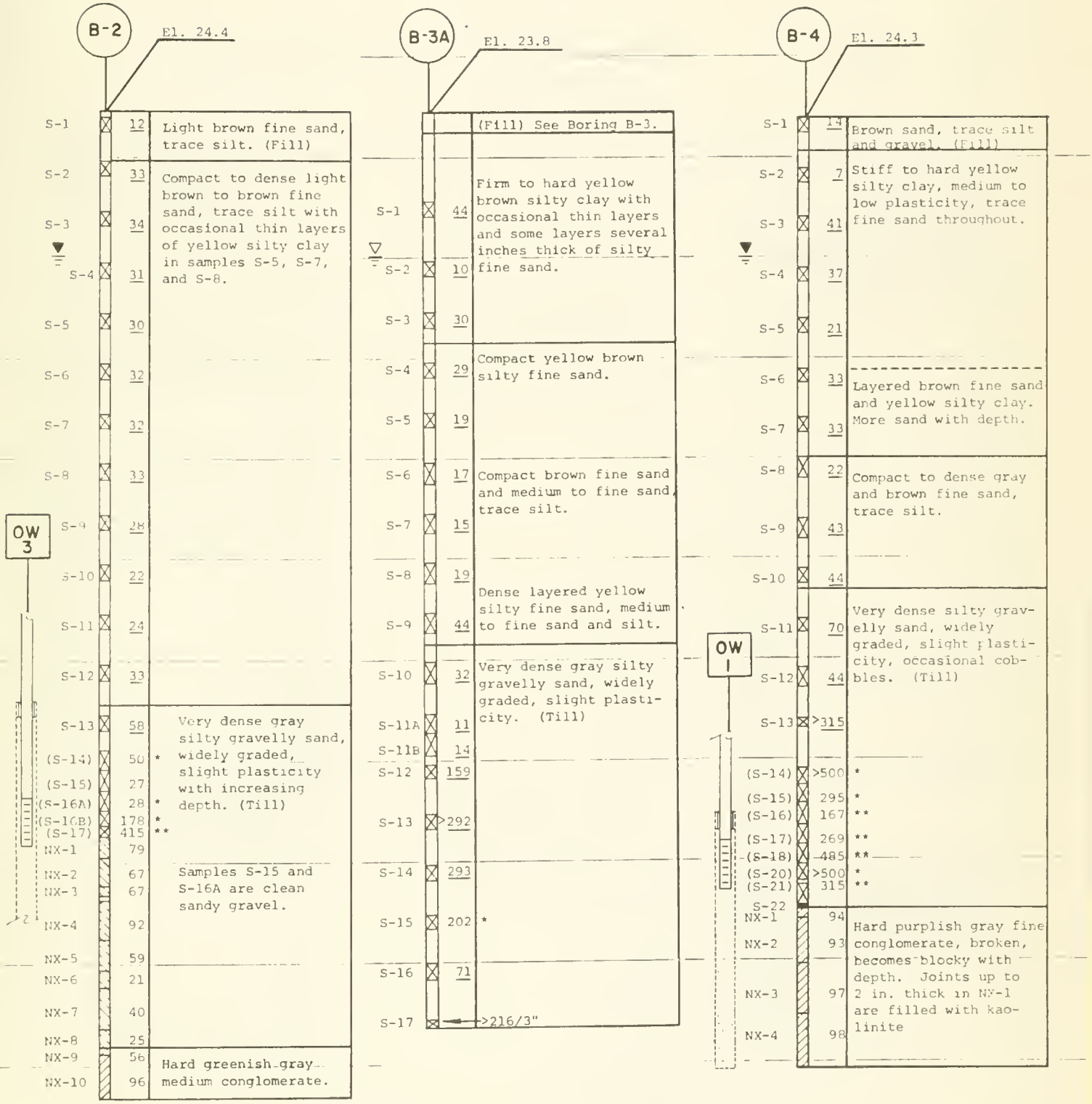
NOTES

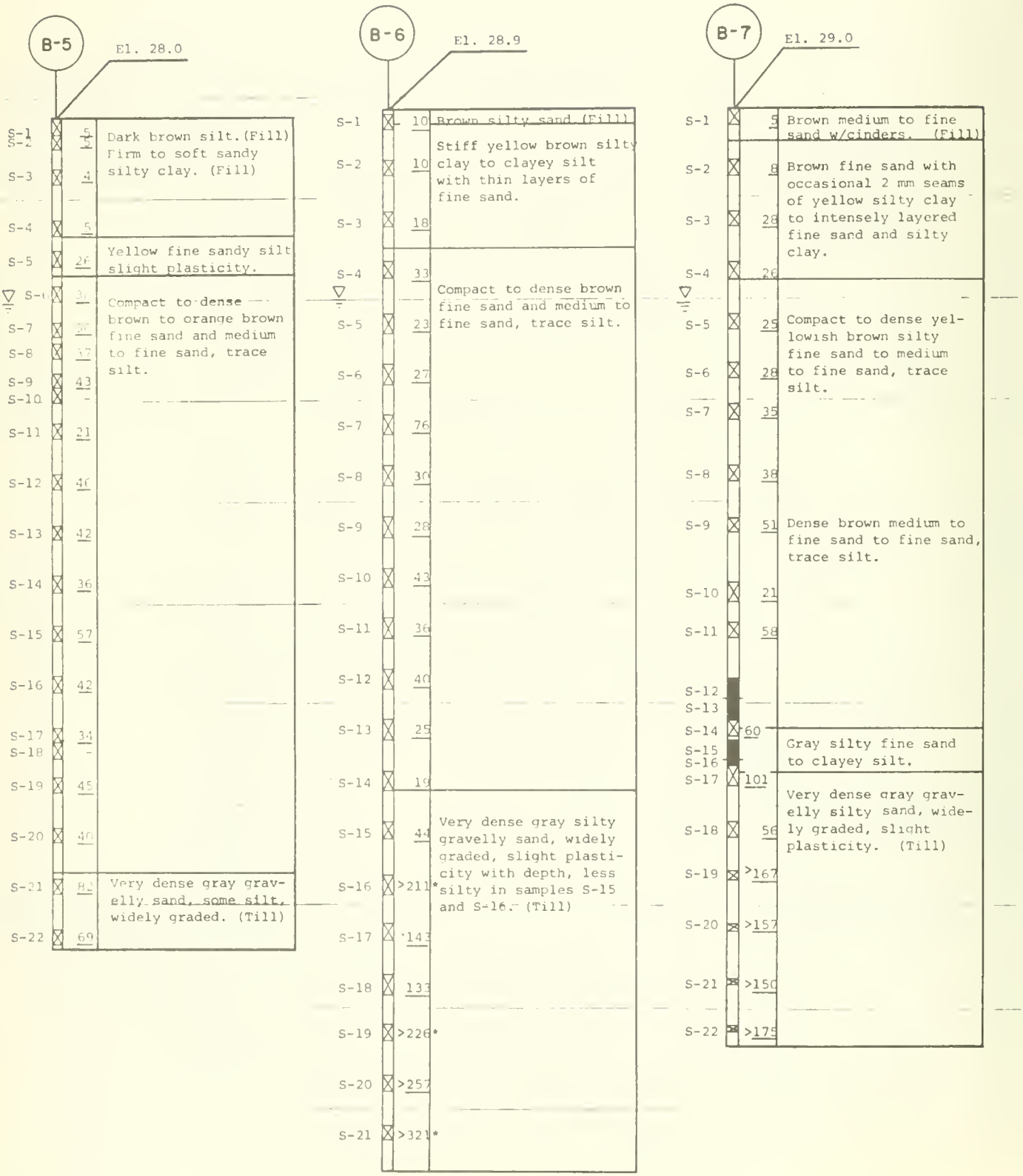
1. Water level taken in boring cased into the till, a minimum of 15 hours after work ended for the day.

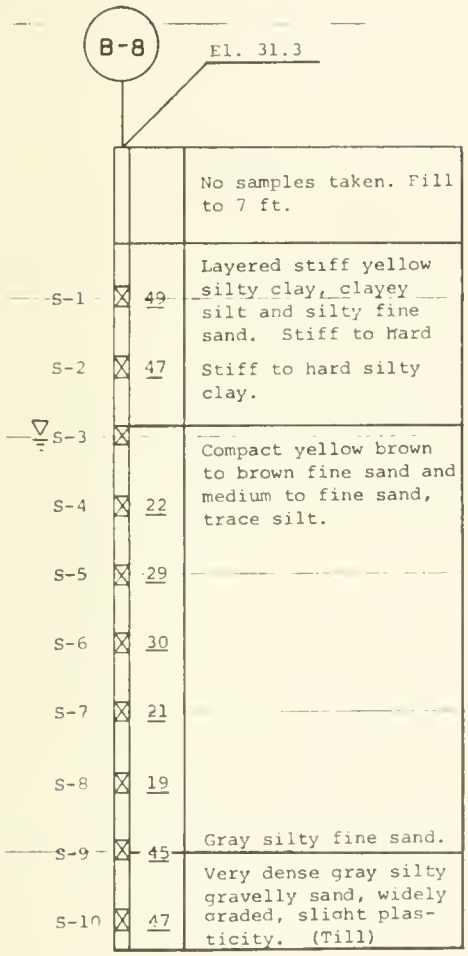
2. All observation wells were installed in completed borings.

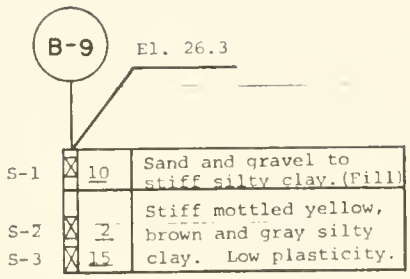
3. Horizontal grid lines on borehole data represent ten foot increments in elevation; all elevations refer to Boston City Base.
   Elevation (Mean Sea Level) = Elevation (BCB) + 5.65 ft

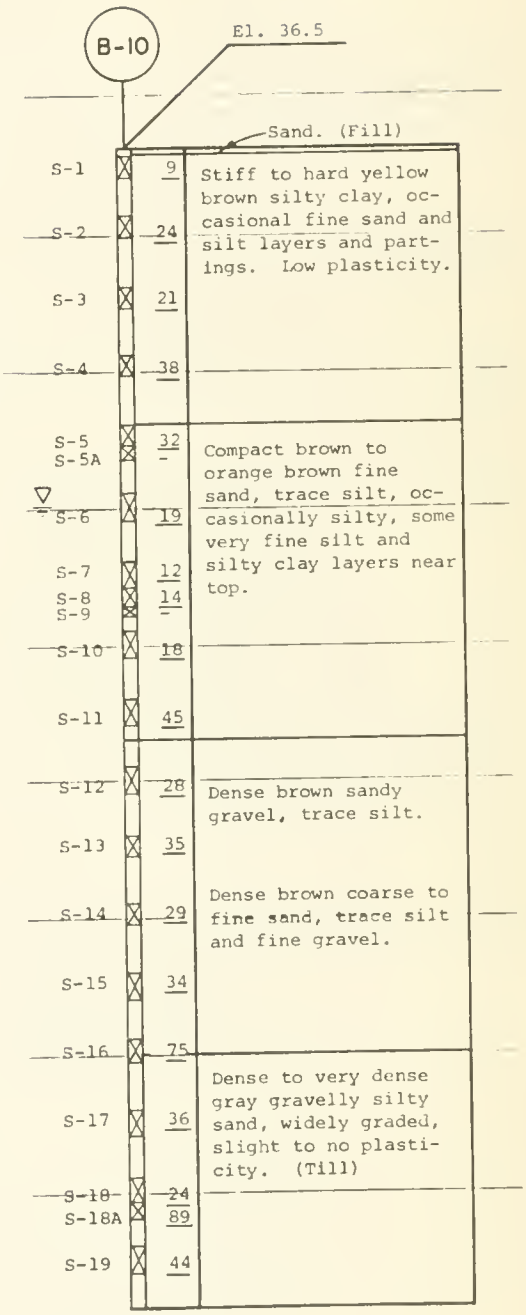
4. Number of Blows per foot which correspond to the Standard Penetration Test (ASTM D 1586-67) are underlined.

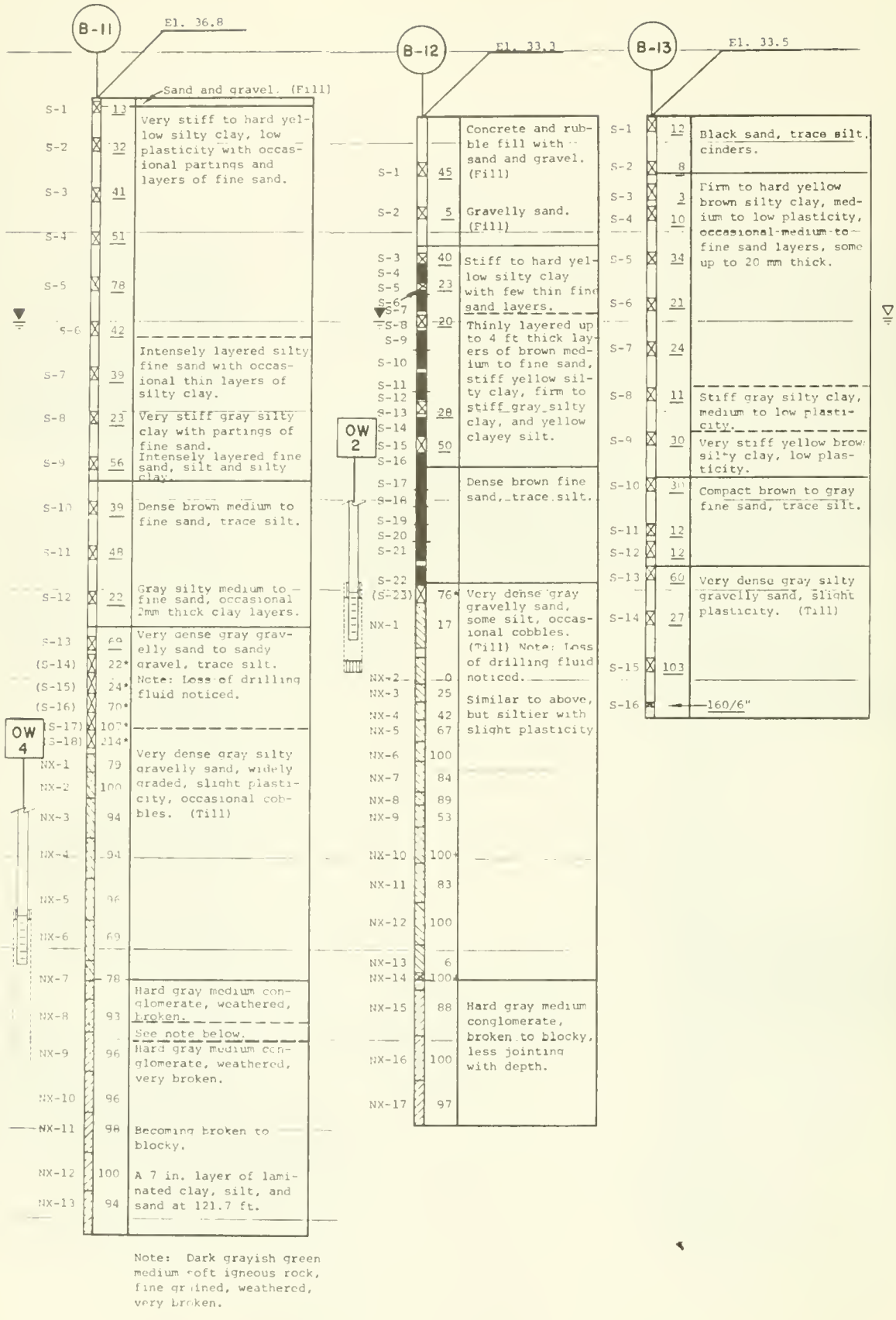

B-2
El. 24.4
S-1 12 Light brown fine sand, trace silt. (Fill)
S-2 33
S-3 34
S-4 31
Compact to dense light brown to brown fine sand, trace silt with occasional thin layers of yellow silty clay in samples S-5, S-7, and S-8.
S-5 30
S-6 32
S-7 32
S-8 33
S-9 28
S-10 22
S-11 24
S-12 33
S-13 58
(S-14) 50 *
(S-15) 27
(S-16A) 28 *
(S-16B) 178 *
(S-17) 415 **
Very dense gray silty gravelly sand, widely graded, slight plasticity with increasing depth. (Till)
NX-1 79
NX-2 67
NX-3 67
NX-4 92
Samples S-15 and S-16A are clean sandy gravel.
NX-5 59
NX-6 21
NX-7 40
NX-8 25
NX-9 56
NX-10 96
Hard greenish-gray medium conglomerate.
OW 3
B-3A
El. 23.8
(Fill) See Boring B-3.
S-1 44
S-2 10
S-3 30
Firm to hard yellow brown silty clay with occasional thin layers and some layers several inches thick of silty fine sand.
S-4 29
S-5 19
Compact yellow brown silty fine sand.
S-6 17
S-7 15
Compact brown fine sand and medium to fine sand, trace silt.
S-8 19
S-9 44
Dense layered yellow silty fine sand, medium to fine sand and silt.
S-10 32
S-11A 11
S-11B 14
S-12 159
S-13 >292
S-14 293
S-15 202 *
S-16 71
S-17 >216/3"
Very dense gray silty gravelly sand, widely graded, slight plasticity. (Till)
B-4
El. 24.3
S-1 14 Brown sand, trace silt and gravel. (Fill)
S-2 7
S-3 41
S-4 37
S-5 21
Stiff to hard yellow silty clay, medium to low plasticity, trace fine sand throughout.
S-6 33
S-7 33
Layered brown fine sand and yellow silty clay. More sand with depth.
S-8 22
S-9 43
Compact to dense gray and brown fine sand, trace silt.
S-10 44
S-11 70
S-12 44
S-13 >315
Very dense silty gravelly sand, widely graded, slight plasticity, occasional cobbles. (Till)
OW 1
(S-14) >500 *
(S-15) 295 *
(S-16) 167 **
(S-17) 269 **
(S-18) 485 **
(S-20) >500 *
(S-21) 315 **
S-22
NX-1 94
NX-2 93
NX-3 97
NX-4 98
Hard purplish gray fine conglomerate, broken, becomes blocky with depth. Joints up to 2 in. thick in NX-1 are filled with kaolinite


B-5
El. 28.0
S-1
S-2
S-3
S-4
S-5
S-6
S-7
S-8
S-9
S-10
S-11
S-12
S-13
S-14
S-15
S-16
S-17
S-18
S-19
S-20
S-21
S-22
5
5
4
5
26
34
36
37
43
21
46
42
36
57
42
34
45
40
82
69
Dark brown silt. (Fill) Firm to soft sandy silty clay. (Fill)
Yellow fine sandy silt slight plasticity.
Compact to dense brown to orange brown fine sand and medium to fine sand, trace silt.
Very dense gray gravelly sand, some silt, widely graded. (Till)
B-6
El. 28.9
S-1
S-2
S-3
S-4
S-5
S-6
S-7
S-8
S-9
S-10
S-11
S-12
S-13
S-14
S-15
S-16
S-17
S-18
S-19
S-20
S-21
10
10
18
33
23
27
76
30
28
43
36
40
25
19
44
>211*
143
133
>226*
>257
>321*
Brown silty sand (Fill)
Stiff yellow brown silty clay to clayey silt with thin layers of fine sand.
Compact to dense brown fine sand and medium to fine sand, trace silt.
Very dense gray silty gravelly sand, widely graded, slight plasticity with depth, less silty in samples S-15 and S-16. (Till)
B-7
El. 29.0
S-1
S-2
S-3
S-4
S-5
S-6
S-7
S-8
S-9
S-10
S-11
S-12
S-13
S-14
S-15
S-16
S-17
S-18
S-19
S-20
S-21
S-22
5
8
28
26
25
28
35
38
51
21
58
60
101
56
>167
>157
>150
>175
Brown medium to fine sand w/cinders. (Fill)
Brown fine sand with occasional 2 mm seams of yellow silty clay to intensely layered fine sand and silty clay.
Compact to dense yellowish brown silty fine sand to medium to fine sand, trace silt.
Dense brown medium to fine sand to fine sand, trace silt.
Gray silty fine sand to clayey silt.
Very dense gray gravelly silty sand, widely graded, slight plasticity. (Till)

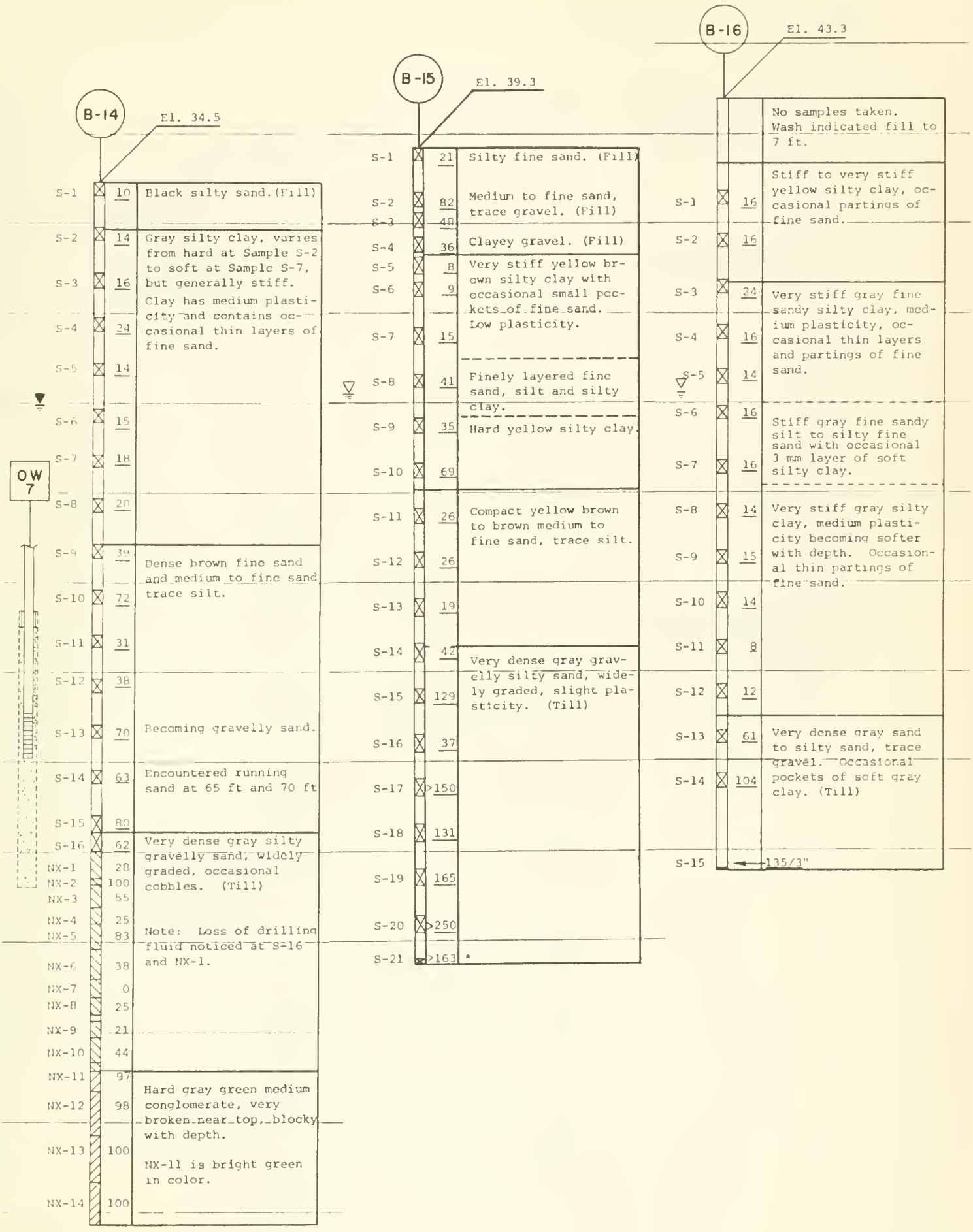

B-8
El. 31.3
No samples taken. Fill to 7 ft.
S-1 49
Layered stiff yellow silty clay, clayey silt and silty fine sand. Stiff to Hard
S-2 47
Stiff to hard silty clay.
S-3
Compact yellow brown to brown fine sand and medium to fine sand, trace silt.
S-4 22
S-5 29
S-6 30
S-7 21
S-8 19
S-9 45
Gray silty fine sand.
S-10 47
Very dense gray silty gravelly sand, widely graded, slight plasticity. (Till)

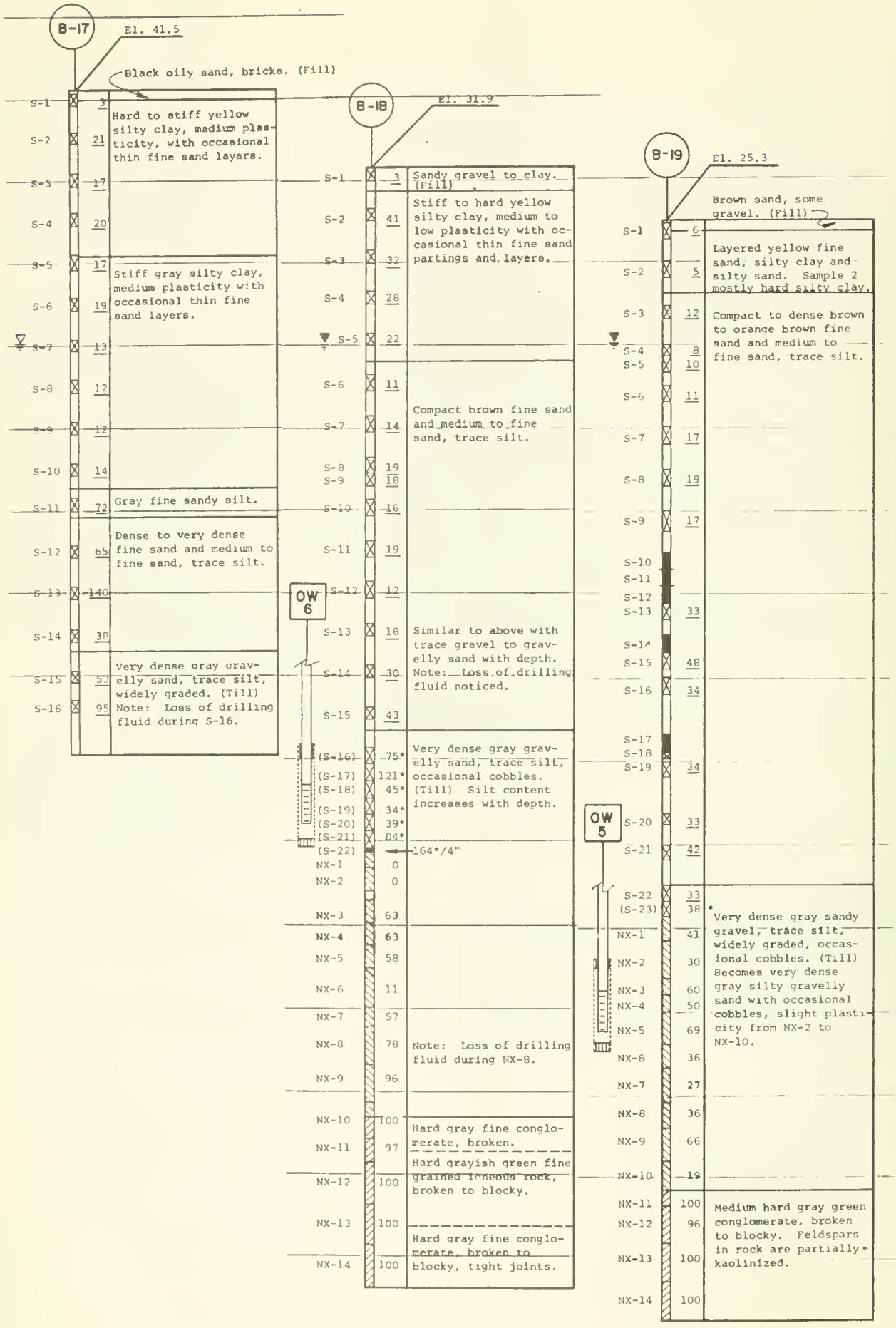

B-9
El. 26.3
S-1 10
Sand and gravel to stiff silty clay. (Fill)
S-2 7
S-3 15
Stiff mottled yellow, brown and gray silty clay. Low plasticity.


B-10
El. 36.5
Sand. (Fill)
S-1 9
S-2 24
S-3 21
S-4 38
Stiff to hard yellow brown silty clay, occasional fine sand and silt layers and partings. Low plasticity.
S-5 32
S-5A
S-6 19
S-7 12
S-8 14
S-9
S-10 18
S-11 45
Compact brown to orange brown fine sand, trace silt, occasionally silty, some very fine silt and silty clay layers near top.
S-12 28
S-13 35
S-14 29
S-15 34
Dense brown sandy gravel, trace silt.
Dense brown coarse to fine sand, trace silt and fine gravel.
S-16 75
S-17 36
S-18 24
S-18A 89
S-19 44
Dense to very dense gray gravelly silty sand, widely graded, slight to no plasticity. (Till)



Note: Dark grayish green medium soft igneous rock, fine grained, weathered, very broken.


B-14
El. 34.5
S-1 10 Black silty sand. (Fill)
S-2 14
S-3 16
Gray silty clay, varies from hard at Sample S-2 to soft at Sample S-7, but generally stiff. Clay has medium plasticity and contains occasional thin layers of fine sand.
S-4 24
S-5 14
S-6 15
S-7 18
S-8 20
S-9 39
Dense brown fine sand and medium to fine sand trace silt.
S-10 72
S-11 31
S-12 38
S-13 70
Becoming gravelly sand.
S-14 63
Encountered running sand at 65 ft and 70 ft
S-15 80
S-16 62
Very dense gray silty gravelly sand, widely graded, occasional cobbles. (Till)
NX-1 28
NX-2 100
NX-3 55
NX-4 25
NX-5 83
Note: Loss of drilling fluid noticed at S-16 and NX-1.
NX-6 38
NX-7 0
NX-8 25
NX-9 21
NX-10 44
NX-11 97
NX-12 98
Hard gray green medium conglomerate, very broken near top, blocky with depth.
NX-13 100
NX-11 is bright green in color.
NX-14 100
OW 7
B-15
El. 39.3
S-1 21 Silty fine sand. (Fill)
S-2 82
S-3 48
Medium to fine sand, trace gravel. (Fill)
S-4 36 Clayey gravel. (Fill)
S-5 8
S-6 9
Very stiff yellow brown silty clay with occasional small pockets of fine sand. Low plasticity.
S-7 15
S-8 41
Finely layered fine sand, silt and silty clay.
S-9 35 Hard yellow silty clay.
S-10 69
S-11 26
S-12 26
Compact yellow brown to brown medium to fine sand, trace silt.
S-13 19
S-14 42
Very dense gray gravelly silty sand, widely graded, slight plasticity. (Till)
S-15 129
S-16 37
S-17 >150
S-18 131
S-19 165
S-20 >250
S-21 >163 *
B-16
El. 43.3
No samples taken. Wash indicated fill to 7 ft.
S-1 16
S-2 16
Stiff to very stiff yellow silty clay, occasional partings of fine sand.
S-3 24
S-4 16
S-5 14
Very stiff gray fine sandy silty clay, medium plasticity, occasional thin layers and partings of fine sand.
S-6 16
S-7 16
Stiff gray fine sandy silt to silty fine sand with occasional 3 mm layer of soft silty clay.
S-8 14
S-9 15
Very stiff gray silty clay, medium plasticity becoming softer with depth. Occasional thin partings of fine sand.
S-10 14
S-11 8
S-12 12
S-13 61
Very dense gray sand to silty sand, trace gravel. Occasional pockets of soft gray clay. (Till)
S-14 104
S-15 135/3"


B-17
El. 41.5
Black oily sand, bricks. (Fill)
S-1 3
S-2 21
Hard to stiff yellow silty clay, madium plasticity, with occasional thin fine sand layars.
S-3 17
S-4 20
S-5 17
S-6 19
Stiff gray silty clay, medium plasticity with occasional thin fine sand layers.
S-7 13
S-8 12
S-9 12
S-10 14
S-11 72
Gray fine sandy silt.
S-12 65
Dense to very dense fine sand and medium to fine sand, trace silt.
S-13 140
S-14 38
S-15 53
Very dense gray gravelly sand, trace silt, widely graded. (Till)
S-16 95
Note: Loss of drilling fluid during S-16.
B-18
El. 31.9
S-1 3
Sandy gravel to clay. (Fill)
S-2 41
Stiff to hard yellow silty clay, medium to low plasticity with occasional thin fine sand partings and layers.
S-3 32
S-4 28
S-5 22
S-6 11
S-7 14
Compact brown fine sand and medium to fine sand, trace silt.
S-8 19
S-9 18
S-10 16
S-11 19
S-12 12
S-13 18
Similar to above with trace gravel to gravelly sand with depth.
S-14 30
Note: Loss of drilling fluid noticed.
S-15 43
(S-16) 75*
(S-17) 121*
(S-18) 45*
(S-19) 34*
(S-20) 39*
(S-21) 84*
(S-22) 164*/4"
Very dense gray gravelly sand, trace silt, occasional cobbles. (Till) Silt content increases with depth.
NX-1 0
NX-2 0
NX-3 63
NX-4 63
NX-5 58
NX-6 11
NX-7 57
NX-8 78
Note: Loss of drilling fluid during NX-8.
NX-9 96
NX-10 100
Hard gray fine conglomerate, broken.
NX-11 97
Hard grayish green fine grained igneous rock, broken to blocky.
NX-12 100
NX-13 100
Hard gray fine conglomerate, broken to blocky, tight joints.
NX-14 100
OW 6
OW 5
B-19
El. 25.3
Brown sand, some gravel. (Fill)
S-1 6
S-2 5
Layered yellow fine sand, silty clay and silty sand. Sample 2 mostly hard silty clay.
S-3 12
S-4 8
S-5 10
S-6 11
Compact to dense brown to orange brown fine sand and medium to fine sand, trace silt.
S-7 17
S-8 19
S-9 17
S-10
S-11
S-12
S-13 33
S-14
S-15 48
S-16 34
S-17
S-18
S-19 34
S-20 33
S-21 42
S-22 33
(S-23) 38
NX-1 41
NX-2 30
NX-3 60
NX-4 50
NX-5 69
NX-6 36
NX-7 27
NX-8 36
NX-9 66
NX-10 19
Very dense gray sandy gravel, trace silt, widely graded, occasional cobbles. (Till) Becomes very dense gray silty gravelly sand with occasional cobbles, slight plasticity from NX-2 to NX-10.
NX-11 100
NX-12 96
NX-13 100
NX-14 100
Medium hard gray green conglomerate, broken to blocky. Feldspars in rock are partially kaolinized.

APPENDIX B
NOISE MEASUREMENT AND ANALYSIS

APPENDIX B

NOISE MEASUREMENT AND ANALYSIS

Noise Measuring Instrumentation

The 24-hour measurement sample was made by means of a Bruel & Kjaer (B & K) Model 166/S.45 Environmental Noise Classifier, using a B & K Type 4117 one-inch ceramic microphone with a foam windscreen. This instrument classifies sound levels into twelve amplitude bands, each having a bandwidth of 2.5 dB. A-weighted sound levels are automatically sampled at 0.6 second intervals and accumulated in the appropriate band. The accumulated levels are displayed in units of tenths of minutes and recorded at 1-hour intervals throughout the 24-hour period. The 166/S.45 Environmental Noise Classifier is a sound level meter (Type 2/S) which meets the specifications of the American National Standards Institute (ANSI S1.4-1971).

The spot check measurement samples were made with a B & K Type 2209 Precision Sound Level Meter with a Type 1613 Octave Band Filter Set. The instrument was mounted on a tripod, with the microphone approximately 4-1/2 feet above street level.

In each case the instruments were calibrated with a B & K Type 4230 Acoustic Calibrator or a Type 4220 Pistonphone prior to the commencement of and at the end of each measurement period.

APPENDIX C
DETERMINATION OF VEHICLE EMISSION RATES

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DETERMINATION OF VEHICLE EMISSION RATES

In both the diffusion modeling analysis and equivalent emission techniques, an essential consideration is the average regional pollutant emission rate in mass of pollutant/vehicle mile traveled (VMT). In the predictive modeling this emission rate is used to determine the emission source strengths in units of mass/time/length of roadway. For the emission burden technique, changes in the pollutant emission burden can be calculated if the average emission rate can be projected.

This procedure to determine emission rates takes into account the Federal Motor Vehicle Emission Control Program (FMVCP). The FMVCP is the current vehicle emission control program promulgated to reduce allowable auto exhaust, crankcase and evaporative emissions. Originally, standards were set in 1971 such that by 1975 all automboiles sold in the United States were to be equipped with emission control devices to limit the exhaust emissions of CO and hydrocarbons to meet these final standards, with nitrogen oxides emission standards to be achieved by the 1977 model year. These original standards, which called for CO reductions of approximately 96% from average pre-1968 model emissions to the 1975 models at all speeds, have been altered. Under the FMVCP, the improvement of vehicle emissions will not be complete until approximately 1990.

To calculate the average emission rate per vehicle for a given calendar year the following factors must be considered:

1) An emission factor (g/veh mile) for each pollutant is used for each model year and for each vehicle type. Vehicle types are light-duty, including automobiles and trucks under 6,000 pounds gross vehicle weight, heavy-duty gasoline, including gasoline vehicles larger than 6,000 pounds gross vehicle weight, and all diesel vehicles, regardless of model year. Medium-duty vehicles comprise 85% of the gasoline-powered heavy-duty vehicles.

Calculation of Roadway Vehicle Emission Strengths

Roadway vehicle emission strengths in units of mass of pollutant per unit length of roadway, per unit time are also required for diffusion modeling input. The calculation of this emission strength is accomplished with the following equation:

$$e = V \cdot eV \left(1.726 \times 10^{-4} \frac{\text{mile-hr-mg}}{\text{m-sec-g}}\right) \qquad \text{(C-2)}$$

where

e = free flow vehicle roadway emission strength (mg/m/sec)

V = free flow vehicle volume in vehicles/hr

eV = emission rate (from Eq. C-1 above) (g/veh-mile)

The contribution from idling during a queuing situation is calculated by considering an idling emission rate in g/min-veh, and dividing by the average length of a vehicle. Hence, to calculate the vehicle roadway emission strength when both free flow, and idling are occuring within the same time period, the following expression is used:

$$e' = e + \gamma(ei) \qquad \text{(C-3)}$$

where

e' = the total roadway vehicle emission strength

e = the free flow vehicle emission strength (mg/m/sec)

ei = the idling vehicle emission strength (mg/m/sec)

γ = percent of idling during time period.

2) Deterioration factors are included for each pollutant for each vehicle type and for each model year. These factors reflect the fact that engine emissions will increase and emission control efficiences will decrease with age of the vehicle.

3) A vehicle mix or a percentage breakdown of the total vehicle population, both by model year and by vehicle type characteristic of the region under study is needed. These were obtained from "The Technical Support Document for the Boston Transportation Control Plan," 1973.

4) Reduction factors for a particular model year due to changes in emission control systems, such as by retrofit, specified as part of an air quality control strategy.

5) A speed adjustment factor is necessary. For CO and HC, this adjustment factor varies inversely with speed, whereas for nitrogen oxides, it varies directly with speed.

In algebraic form the above procedures for each pollutant and vehicle type reduce to:

$$eV = S \cdot \sum_{i=n-12}^{n+1} C_i \cdot m_i \cdot d_i \cdot a_i \cdot s \qquad \text{(C-1)}$$

where

eV = average emission per vehicle for calendar year n (g/veh-mi)

C_i = emission factor for ith model year (g/veh-mi)

m_i = proportion of vehicle use by model year

d_i = deterioration factor for ith model year

a_i = reduction factors applicable to ith model year

s = speed adjustment factor.

TABLE C-1

LIGHT-DUTY VEHICLE CO EXHAUST EMISSION STANDARDS
REQUIRED BY THE FEDERAL MOTOR VEHICLE CONTROL PROGRAM (FMVCP)

Vehicle Model Year	Emission Standards (grams/vehicle-mile)
1973, 1974	39
1975, 1976	15
1977[1]	15
1978 and Post-1978[1,2]	3.4

[1]As of March 5, 1975

[2]EPA has indicated possible modifications to the FMVCP which could delay the implementation of final vehicle emission standards beyond 1978

APPENDIX D

TECHNIQUES OF ATMOSPHERIC DIFFUSION MODELING

APPENDIX D

TECHNIQUES OF ATMOSPHERIC DIFFUSION MODELING

Diffusion modeling is a mathematical tool used in the field of air pollution to simulate the various processes that affect airborne effluents from a pollutant source or group of sources from the time they leave the source until the time they arrive at the receptor. A model takes into account physical atmospheric processes that transport and diffuse an effluent. By use of a computer, one can calculate the impact of various meteorological conditions and source characteristics upon pollutant concentrations at both ground level and at the heights of important elevated receptors. Modeling is accepted by the Federal Environmental Protection Agency (EPA, 1974) as an appropriate tool in determining the air quality impact of various pollutant sources.

A.1 The Effects of Meteorology on Diffusion

Once a pollutant source at or near the ground emits an effluent into the atmosphere, meteorological conditions affect both the transport and diffusion of the effluent. Plume transport is determined largely by wind speed and direction. The general wind flow over an area is induced by large scale pressure systems. The intensity of these pressure systems and their location and movements determine the general distribution of wind in a given area. A plume will follow the trajectory of the local wind. An increase in wind speed tends to stretch a plume in the downwind direction thus decreasing its concentration, and a change in wind direction could act in a similar manner to spread a plume over a larger air volume and decrease the concentration over time at any one point.

Wind speed is usually measured in knots or miles per hour. A wind speed class is defined by the range of wind speeds likely to accompany a particular weather condition or stability class. For example, in an unstable weather condition, wind speeds are likely to range from 2 to 12 miles per hour. It is physically impossible to have an unstable condition with winds of 50 miles per hour. During neutral stability, however, winds up to 35 miles per hour would be reasonable. Thus, when a model considers neutral weather conditions, the appropriate wind speed classes

will have winds from 4 to 35 miles per hour. For purposes of modeling, 16 wind directions are defined by dividing a 360° circle into 16 sectors with each sector incorporating a 22.5° segment of the circle.

Plume diffusion is primarily a function of atmospheric turbulence or stability. Turbulent air downwind will cause dilution of the plume. There are two categories of turbulence. Turbulence generated when the motion of the air interacts with topographic features (e.g., trees and buildings) is called mechanical turbulence. Convective turbulence results when the air is cooler than the ground surface over which it flows and is heated by contact with the ground.

The intensity of turbulence, which affects how quickly the effluents will be dispersed, is dependent upon the thermal stratification or stability of the atmospheric layer within which the plume is located. Stability conditions are classified in three broad categories: unstable, neutral and stable. Under stable - i.e., inversion or subadiabatic* - conditions, air temperature increases or is isothermal with height and the atmosphere is stagnant and very calm. Consequently, any pollutant emitted at ground level tends to accumulate, while effluents from elevated sources stay elevated and do not normally reach the ground until the plume has traveled many kilometers. Ground-level sources are generally the major contributors to ambient SO_2 concentrations under stable conditions. This thermal stratification is common during clear nights with light wind speeds.

Unstable conditions occur on days with light to moderate wind speeds, when strong solar heating occurs, or when cold air is transported over a much warmer surface. In this case, air temperature decreases with height, at a rate exceeding 1°C/100 m. Unstable conditions are usually confined to the lowest 200 meters of the atmosphere and cause low-level emissions to disperse upward rapidly and bring elevated plumes to the ground

*Theoretically, when a small volume of warm air is forced upward in the atmosphere it will encounter lower pressure, expand and cool. If we assume that there is no exchange of heat between the environment and the small volume, we can define the rate at which cooling occurs during the ascent as the dry adiabatic lapse rate (-9.8°C/Km).

rapidly. As a result, elevated sources frequently make large contributions to ambient pollutant concentrations under unstable thermal stratifications.

Finally, when the air temperature lapse rate remains approximately adiabatic, and there is no tendency for a displaced parcel to gain or lose buoyancy, the stratification is called neutral. Near-neutral stability is common under cloudy or windy conditions at any time of day in most locations. The wind flow over the underlying surface under such conditions generates mechanical turbulence and, thus, good mixing. During high wind speeds and neutral conditions, emissions from sources with tall stacks often result in high ground-level concentrations because of the suppression of plume rise. For ground-level emissions, the concentrations for near-neutral conditions normally range between those for stable and unstable conditions.

The most direct method for determining local stability (and, thus, the dispersive capability of the atmosphere) entails frequent soundings to monitor the actual temperature gradient to a height of several thousand feet. However, the release of radiosonde balloons to achieve such information is performed only twice daily at a relatively few weather stations in the United States. Thus, alternative classification schemes, based upon routinely available observations made at most National Weather Service stations, have been developed to afford an indirect determination of stability on an hourly basis.

The most widely-accepted classification scheme was suggested by Turner (1964). This technique, which is derived chiefly from earlier experimental work by Pasquill (1962), defines stability near the ground in terms of net solar radiation and wind speed. During the day, hourly observations of cloud cover and ceiling height may be combined with the local solar altitude, determined from astronomical tables, to characterize surface insolation. At night, the net radiation is negative (outgoing), and the cloud cover and ceiling height again provide a basis for determining a 'radiation index'. The six Turner stability classes correspond to specific radiation-wind speed combinations, each of which has been empirically associated with a degree of atmospheric mixing capacity. Table D-1 presents the Turner atmospheric stability classification system (Turner, 1969).

TABLE D-1

A General Key to the Turner Stability Classification System

Surface Wind m/sec	Day Incoming Solar Radiation			Night *Thin Overcast or ≤ 3/8 Cloud Cover	> 4/8 Cloud Cover
	Strong	Moderate	Slight		
< 2	A	A-B	B	-	-
2-3	A-B	B	C	F	E
3-5	B	B-C	C	E	D
5-6	C	C-D	D	D	D
> 6	C	D	D	D	D

A Extremely Unstable

B Moderately Unstable

C Slightly Unstable

D Neutral

E Stable

F Extremely Stable

*Neutral Conditions Assumed for All Overcast Conditions

Using the Turner scheme described above, a stability wind rose can be derived from surface weather observations taken at a National Weather Service observation station. The stability wind rose delineates the joint frequency distribution of each wind speed class, wind direction, and atmospheric stability.

D.2 Description of Modeling Techniques

In this analysis of the air quality impact of the proposed plant, ERT's Gaussian point source diffusion model (PSDM) was employed. Short-term (3-hour and 24-hour) pollutant concentrations were determined at each point of a polar grid, which was defined at downwind distances from 0.1 to 10 km along the centerline of 16 wind directions, around the proposed plant. PSDM was used to calculate SO_2 concentrations due to peak load emissions during each of 768 weather conditions (8 stabilities x 6 wind speeds x 16 wind directions) as presented in Table D-2.

The annual average concentrations were based on peak monthly emissions of SO_2, NO_x, particulates and a stability wind rose derived from surface weather observations taken hourly at Logan Airport, Boston. Data from Logan was used because the weather conditions there best typify conditions in most of the city of Boston, including the medical area.

The fundamental equation used in the model is the Gaussian plume equation which estimates ground-level pollutant concentrations from an elevated point source (a typical stack), as presented in the Workbook of Atmospheric Diffusion Estimates, (Turner, 1969). The general form of the equation for the coordinate system presented in Figure D-1 is:

$$\chi(0,0,z) = \frac{q(x, -y, H)}{2\pi\sigma_y\sigma_z u} \exp\left[-1/2\left(\frac{y}{\sigma_y}\right)^2\right]$$

$$\cdot \exp\left[-1/2\left(\frac{z - H}{\sigma_z}\right)^2\right] + \exp\left[-1/2\left(\frac{z + H}{\sigma_z}\right)^2\right] \cdot \left[e^{-t/\lambda}\right]. \quad \text{(D-1)}$$

TABLE D-2

SPECIFICATION OF ATMOSPHERIC STABILITY AND WIND SPEEDS

Stability Class (Weather Conditions)	Description	Wind Speed Class 1	2	3	4	5	6
		Miles per Hour					
1	Very Unstable	2	3	4	5	6	7
2	Unstable	2	4	6	8	10	12
3	Neutral	4	8	12	20	27	35
4	Stable	2	4	6	8	10	12
5	Inversion Lid - Very Unstable Below	2	3	4	5	6	7
6	Inversion Lid - Unstable Below	2	4	6	8	10	12
7	Inversion Lid - Neutral Below	2	4	6	8	10	12
8	Fumigation	2	4	6	8	10	12

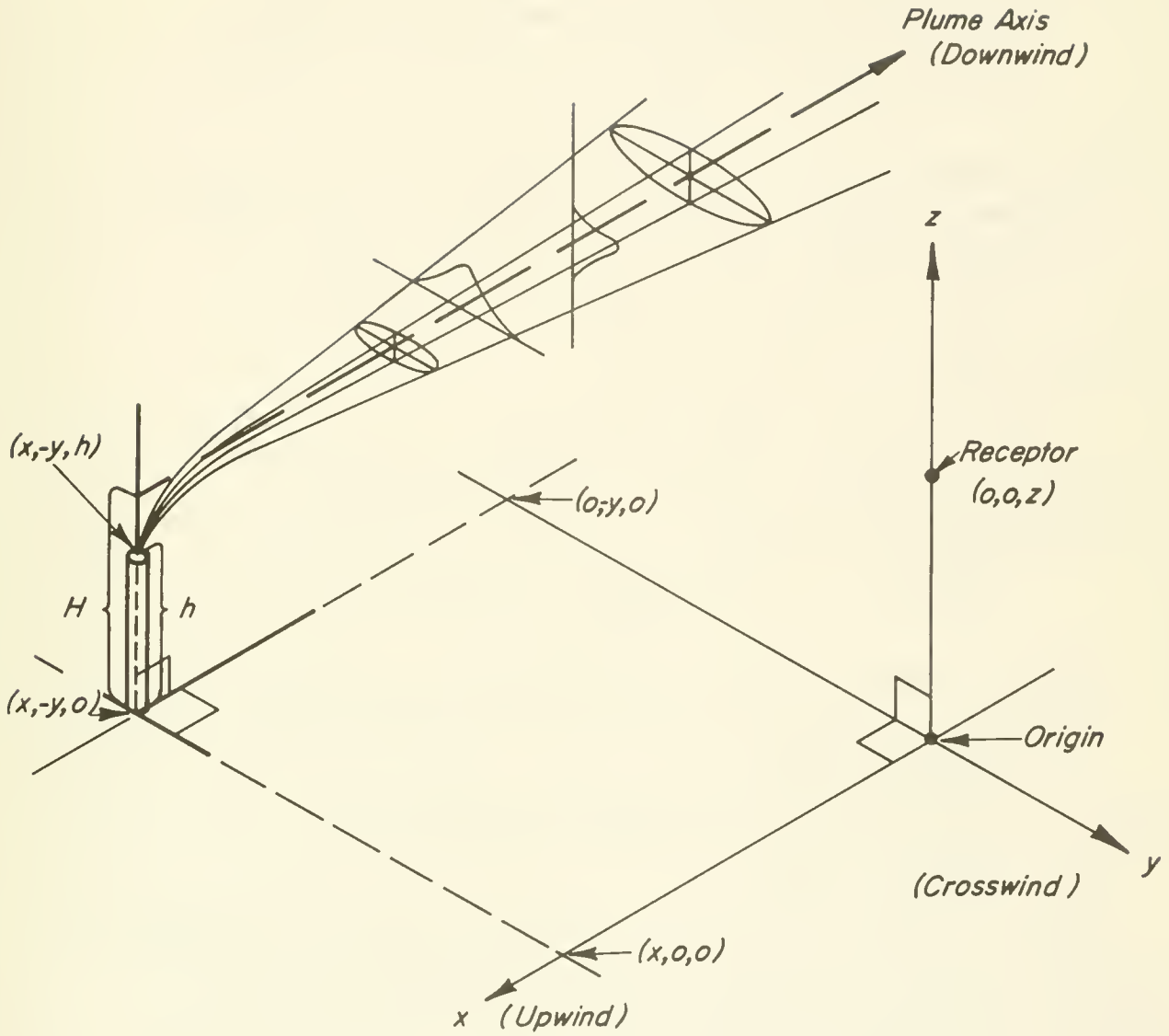

Figure D-1 Coordinate System Showing Gaussian Distributions in the Crosswind and Vertical Directions.

where

(x,y,z) are the (upwind, cross-wind, and vertical) components of a Cartesian coordinate system, such that the receptor point is located at or vertically above the origin (expressed in units of length) and the source at the point $(x, -y, H)$

$\chi(0,0,z)$ is the ground-level pollutant concentration from an elevated point source at a receptor $(0,0,z)$ (mass/length^3)

H is the effective height (stack height plus plume rise) of emission, and, therefore, the centerline height of the plume (length)

q is the source strength (mass/time)

σ_y, σ_z are dispersion coefficients that are measures of cross-wind and vertical plume spread. These two parameters are functions of downwind distance and atmospheric stability (length)

u is average wind speed (length/time)

λ is a decay time for a particular contaminant in the atmosphere (time)

and t is the travel time from source to receptor and equals x/u (time)

The source base is at $z = 0$ in the coordinate system, and the plume centerline reaches the equilibrium height H (plume rise plus stack height) at some distance downwind from the source. The most important assumptions upon which the equation are based are the following:

1. The wind speed and direction in the vicinity of the point source are constant throughout the period of interest. The wind speed, however, is specified as an increasing function of height.

2. When the effluent enters the atmosphere, the plume rises until it reaches an equilibrium altitude; under calm atmospheric conditions ($u \leq 3.1$ mph) the plume centerline height remains

at this altitude for all downwind distances. For all other conditions, plume centerline height is a function of distance until the equilibrium height is attained.

3. At any downwind distance, the maximum concentration occurs at the plume centerline. The distribution of concentration values off the centerline is given by the product of two Gaussian, or bell-shaped curves.

4. The concentration profiles described by the Gaussian form are not "instantaneous" plume profiles. Instead they represent concentrations averaged over one hour. (Modifications for other time intervals are discussed below).

5. None of the effluent is lost from the plume. Therefore, when the plume intersects the ground surface, it is assumed that all material is reflected back above the ground.

6. The effluent rate is constant, and the meteorological parameters determining plume goemetry are constant; (i.e., the equation represents steady state conditions).

PSDM was designed to provide estimates of the downwind profile of short-term concentrations resulting from the emissions of elevated point sources (such as tall stacks). Ground-level pollutant concentrations along the direction of the plume centerline are computed for each of 768 weather conditions. This model was used to analyze the 3-hour, 24-hour and annual concentrations of SO_2, NO_X, and particulates resulting from the operation of the proposed Medical Area Total Energy Plant.

Specification of Stability Categories

PSDM predicts downwind concentrations expected during a spectrum of 8 stability classes (including very unstable to stable) by the well-known Gaussian diffusion formula for an elevated, continuously emitting point source as presented in Equation D-1. For computational efficiency, the seven Turner categories (see Table D-1) have been condensed to four categories. Class 1 in Table D-2 corresponds to a composite of Turner categories A and B; classes 2 and 3 in the table are comparable to Turner's classes C and D, respectively. Stable category (class 4 in Table D-2) combines the remaining Turner classes (E and F). The

classification scheme depicted in Table A-2 also allows for the consideration of four elevated inversion situations. These conditions, represented in the table as classes 5 through 8, occur relatively infrequently but are included because emissions from tall stacks could produce high ground-level concentrations under inversion conditions. Category 5 simulates an elevated inversion with a very unstable atmosphere below the inversion. Similarly, stability classes 6 and 7 characterize and inversion lid with unstable and neutral atmospheres below, respectively. Stability class 8 represents the fumigation conditions which accompany the breakup of the nocturnal inversion.

As stated previously, the basic meteorological data used in the analysis was derived (by the National Climatic Center) according to the Turner Classification Scheme. The frequency of the 8 PSDM stabilities was based on the frequency of the 6 Turner stability classes as follows:*

$$\begin{aligned}
\text{Stability 1} &= 0.98\ [\Sigma\ (A+B)] \\
\text{Stability 2} &= 0.98\ C \\
\text{Stability 3} &= 0.98\ D\ (u \leq 16.5 \text{ knots}) \\
&\quad\ 1.00\ D\ (u > 16.5 \text{ knots}) \\
\text{Stability 4} &= \Sigma\ (E+F) \\
\text{Stability 5} &= 0.02\ [\Sigma\ (A+B)] \\
\text{Stability 6} &= 0.02\ C \\
\text{Stability 7} &= 0.02\ D\ (u < 16.5 \text{ knots}) \\
\text{Stability 8} &= 0.02\ [\Sigma\ (E+F)]
\end{aligned}$$

PSDM also incorporates wind speed classes which vary with stability category as presented in Table D-2. Generally, the lighest winds occur with very unstable stability and the strongest winds occur with neutral stability (Turner, 1969). Six wind speed classes were specified for each stability class. The combination of eight stability classes, six wind speed classes, and 16 wind directions gives a total of 768 weather conditions.

The Calculation of Short-Term Concentrations - Unlimited Mixing

Equation D-1 can be used directly to calculate hourly concentrations reaching both elevated and ground level (z=0) receptors under stability

*This specifies the frequency of each PSDM stability category.

classes 1 through 4. These stabilities parameterize unlimited atmospheric mixing, that is, an atmosphere not capped by an elevated inversion.

In the present analysis contaminant decay rates have been ignored. This represents a conservative procedure, since definitive evidence does not presently exist for choosing a single decay time for each pollutant of interest, and eliminating the decay rate ($e^{t/\lambda} = 1$) leads to some overestimation of concentrations in the range of 5 to 10 miles downwind.

Ground level concentrations expected during stability categories 1 through 4 (unlimited mixing) can be obtained by setting z = 0 in Equation D-1, resulting in

$$\chi(0,0,H) = \frac{q}{\pi\sigma_y\sigma_z u} \exp\left[1/2\left(\frac{y}{\sigma_y}\right)^2\right] \exp\left[1/2\left(\frac{H}{\sigma_z}\right)^2\right] \qquad \text{(D-2)}$$

Hourly concentrations result from the above equations because the dispersion parameters (σ_y,σ_z) were derived from measurements of plume characteristics averaged over 1-hour periods. The actual dispersion parameters were those suggested by the ASME (1965). A study performed by Brookhaven National Laboratory (Manowitz, 1972) in which airplane measurements were made of the Northport plume verified that the dispersion generally followed the parameters suggested by the ASME for elevated point sources. These parameters can be expressed in the functional forms:

$$\sigma_y = ax^b \; ; \; \sigma_z = sc^d$$

where the coefficients a, b, c, and d are specified as shown in Table D-3.

The dispersion coefficients used for the stable condition (class 4 in Tables D-2 and D-3) are the same as those used for neutral conditions. This change enables PSDM to simulate the increased dispersion rates over cities observed by McElroy[1], Bowne[2] and others[3] from model validation tracer studies in cities.

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[1] J. McElroy, "A Comparative Study of Urban and Rural Dispersion" J. Appl. Meteorol 8:19 (1969).

[2] N. E. Bowne, "Diffusion Rates," J. Air Poll. Control Assoc. 24:9 (1974)

[3] G. Hilst and N. Bowne, "Diffusion of Aerosols released Upwind of an Urban Complex," Envir.Sci. and Tech., 5:327 (1971)

TABLE D-3

ASME DISPERSION PARAMETERS USED IN CALCULATING HORIZONTAL AND VERTICAL PLUME DISPERSION FROM ELEVATED POINT SOURCES

	Stability Class	Values of Coefficient and Exponent a	b	c	d
1	Very Unstable	0.40	0.91	0.40	0.91
2	Unstable	0.36	0.86	0.33	0.86
3	Neutral	0.32	0.78	0.22	0.78
4	Stable	0.32	0.78	0.22	0.78
5	Inversion - Very Unstable Below	0.40	0.91	0.40	0.91
6	Inversion - Unstable Below	0.36	0.86	0.33	0.86
7	Inversion - Neutral Below	0.32	0.78	0.22	0.78
8	Fumigation	0.42	0.58	0.37	0.58

The wind speed (u) is specified as an increasing function of height. The vertical variation in wind speed was treated using a power law formulation of vertical wind shear. At heights (Z) less than the atmospheric mixing depth and less than the reference height (Z_o), the reference wind (U_o) is assumed. For $Z_o \leq Z$ F mixing depth,

$$U = U_o \ (Z/Z_o)^{EX} \qquad \text{(D-3)}$$

where

EX is an array of stability dependent exponents equal to 0.09, 0.11, 0.14, 0.20, 0.09, 0.11, 0.14, varying from stability 1 to 7, respectively (DeMarrais, 1959).

U is the wind speed (m/sec)

U_o is the reference wind speed (m/sec)

Z is the height above grade (m)

Z_o is the height at which U_o was measured (m)

For $Z \geq$ mixing depth

$$U = U_o \ (\text{mixing depth}/Z_o)^{EX}$$

U_o is the wind speed specified for each stability class as delineated in Table D-2.

Sector Averaging for 3-Hour Concentrations

Three-hour concentrations are estimated using an option in PSDM which simulates the variability in wind direction that typically occurs over this longer period. The plume is allowed to meander evenly through a sector whose width is stability-dependent. This sector averaging is specified as a modification of Equation D-2 as follows:

$$\chi = \frac{q}{\sqrt{2\pi}\ \sigma_z uc} \exp\ ]1/2\ (\frac{H}{\sigma_z})^2] \qquad \text{(D-4)}$$

where c is the sector width and can be written as

$$c = 2 \times \tan\ (\theta/2)$$

where

θ = 45° for stabilities 1 and 5

θ = 33 3/4° for stabilities 2 and 6

θ = 22 1/2° for stabilities 3, 4 and 7.

A three-hourly concentration is specified as uniformly distributed over a stability-dependent sector width with a larger sector for a more unstable atmosphere.

The short term (3-hr and 24-hr) maximum concentrations calculated by PSDM represent the highest pollutant levels expected in the absence of plume downwash, a phenomenon that can be induced by the aerodynamic turbulence created by tall buildings. The downwind direction of maximum concentrations is not specified; it is assumed that for any future year the concurrence of the short term meteorological conditions that would produce high pollutant levels is equally probable for all directions. This assumption is likely to result in conservatively high concentrations for some directions (when predicted values are compared with historical records); but the predicted maximum concentrations are likely to occur in at least one downwind direction. A risk estimate for a given direction may be derived from the 5 year historical wind rose data presented in Figure D-2. This wind rose gives the relative frequency of occurrence of each wind speed class and wind direction for all stability classes as derived from surface weather observations at Logan Airport, Boston.

Calculation of 24-Hour Maximum Concentrations

Meteorological data used as input to the diffusion model calculations (i.e., PSDM) are generally available as 1-hour average values. The Federal Environmental Protection Agency has recommended a procedure to calculate 24-hour concentrations from maximum 1-hour levels expected during atmospheric conditions characterized by the presence of elevated inversions (Federal Register, 25 November 1971). For these atmospheric conditions the inversion effectively creates a "lid" that limits upward

mixing of the plume, and thus increases ground level concentrations. To estimate 24 hour concentrations, for comparison with the 24-hour primary standard, maximum 1-hour concentration expected during these "lidded" cases should be divided by four (4) according to the EPA recommendation. The 24-hour maximum concentrations were all calculated using the EPA method.

Plume Trapping

In addition to the unlimited mixing stabilities, PSDM considers the result of the effluent plume being trapped below an elevated inversion lid. The conditions beneath the elevated inversion vary from very unstable to neutral stabilities (classes 5 to 7). Lidded conditions require a modification of Equations D-2 and D-3. This modification is the classical trapping model* presented in the "Workbook", Equation 5-8, page 38 (Turner, 1969).

In the lidded conditions, the height of the inversion is set at the height of the plume ($H = h_s + \Delta h$) if the plume rise is greather than 350 meters (based on Holzworth, 1972). If the lid were lower than the plume rise, the plume would punch through the inversion into the stable layer and disperse only gradually to the ground. If the lid were higher, the mixing layer would be deeper and, hence, the volume of air in which the plume diffused would be greater. In other words, by setting the lid height at the plume rise, the ground-level concentration is maximized.

Plume Rise

PSDM uses the most recent Briggs plume rise equations (Briggs, 1970) in forms which depend on stability. For unstable and neutral conditions (PSDM stability classes 1, 2, 3, 5, 6, 7, 8)

$$\Delta h = \frac{1.6\ F^{1/3}\ x^{2/3}}{u}, \quad x < 3.5\ x^* \qquad \text{(D-5)}$$

*The actual equation is quite complex. See the "Workbook" for a complete description.

$$\Delta h = \frac{1.6\ F^{1/3}\ (3.5\ x^*)}{u}, \quad x \geq 3.5\ x^* \qquad \text{(D-5)}$$

where

F = Buoyancy flux of stack emissions (m^4/sec^3)*

x^* = Downwind distance at which atmospheric turbulence dominates entrainment in plume rise (m)

$$x^* = \begin{cases} 14\ F^{5/8} \text{ if } F \leq 55\ m^4/s^3 \\ 34.49\ F^{2/5} \text{ if } F > 55\ m^4/s^3 \end{cases}$$

$3.5\ x^*$ = Downwind distance at which the plume becomes level (m)

s = Stability parameter based on atmospheric lapse rate**

$$s = \frac{\partial \theta}{\partial z} \frac{g}{T_a}$$

where

$\partial\theta/\partial z$ is the rate of change of potential temperature*** with height

g is the acceleration due to gravity, and

T_a is the ambient temperature 10°C

For stable conditions (PSDM stability Class 4):

$$\Delta h = \frac{1.6\ F^{1/3}\ x^{2/3}}{u} \qquad x < \pi\ us^{1/2}$$

$$\Delta h = 2.9\ \left(\frac{F}{us}\right)^{1/3} \qquad x \geq \pi\ u\ s^{1/2} \qquad \text{(D-6)}$$

---

*See Briggs, 1970.

**An average value of s was determined as $4.74 \times 10^4\ sec^1$.

***The temperature reached by a parcel of air when this parcel is brought adiabatically to a height equivalent to 1000 millibars of pressure is termed potential temperature.

In this case the limits were determined by the distance of equilibrium plume rise in stable air.

The equation for plume rise in a calm atmosphere defined by winds less than 3.1 mph, is as follows:

$$\Delta h = 5.0\ F^{1/4}\ s^{-3/8} \qquad \text{(D-7)}$$

As stated previously, in the lidded conditions (stabilities 5, 6 and 7), the height of the lid is set at the height of the plume ($H = h_s + \Delta h$) only if the final plume rise is above 350 meters.

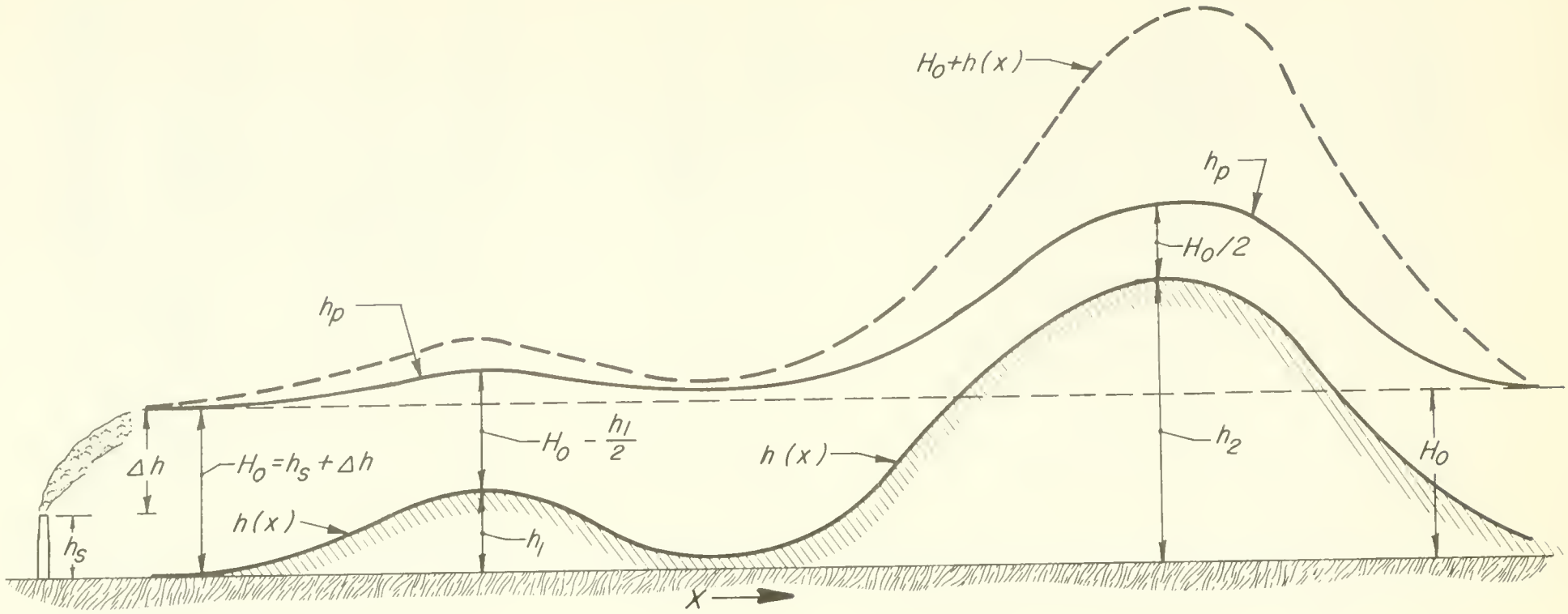
The effect of stack tip downwash is also included in PSDM calculations for exit velocities less than 1.5 times the wind speed. The decrease in stack height is given by the following formula which is based upon the work of Briggs (1974), and that of Sherlock and Stalker (19741):

$$h^1 = h_s + 2(V_s\ u - 1.5)D \quad [\text{for } V_s\ u \leq 1.5] \qquad \text{(D-8)}$$

where h^1 is the effective stack height, h_s is the physical stack height, V_s is the exit velocity, u is the average wind speed, and D is the inside stack diameter. Thus, the minimum effective stack height is three stack diameters lower than the stack top, if exit velocity is essentially zero.

Effects of Terrain

The PSDM program accounts for terrain elevations by permitting the plume to be lifted one-half of the difference between the height of the receptor (the point on the ground for which the concentration is being computed) and the height of the stack base, with the additional restriction that the plume shall always be at least half the height above the ground that it would be were there no topography (Figure D-2). The simultaneous consideration of both the plume rise as a function of downwind distance and of the topography surrounding the point source provides a realistic simulation of the downwind transport of effluent released in areas characterized by irregular terrain.



h_s is physical stack height

Δh is plume rise

H_0 is effective stack height (physical stack height plus plume rise)

$h(x)$ is terrain height above stack base elevation

h_p is plume centerline height above stack base elevation

Figure D-2 Treatment of Terrain Influence Upon Plume Height Used in Model PSPM

Annual Average Concentrations

PSDM calculates the annual average concentration χ for each weather condition at each receptor. The annual average concentration, $\bar{\chi}$, is obtained by summing all concentrations and weighting each one according to its frequency for the particular wind direction, wind speed class, and stability class. The average concentration is

$$\bar{\chi} = \sum_K \sum_L \sum_J F(J,K,L) \quad \chi(J,K,L) \qquad \text{(D-8)}$$

where

$F(J,K,L)$ = normalized frequency during the period of interest for wind direction interval K, wind speed class J, and stability class L

$\chi(J,K,L)$ = average ground-level concentration calculated from Equation D-4 and the trapping model, as appropriate.

The total concentration at a specific receptor is obtained by summing the results of Equation D-8 over all sources. For each of the 16 wind direction intervals, wind speed is defined in 6 categories and stability class in 8 categories. Thus, a three-dimensional array of 768 categories is established. (However, only a few wind directions result in non-zero contributions for a specific receptor.)

When annual average concentrations are predicted, it is the meteorological conditions that occur most frequently that usually dominate the concentration calculation and averaging process. Therefore, the use of a long term (5 to 10 year) historical frequency record is most appropriate for predicting future air quality. Thus, for the present calculations, the meteorological conditions at Logan Airport, Boston from 1965 to 1969, inclusive, were utilized. Because this weather observation station is nearest the proposed power plant (<10 miles) and is influenced by air flow over the city, its data was taken as representative of the site and its vicinity.

Conservatism in the PSDM Simulations

A substantial data base is required for calibration, and since appropriate short-term monitoring data are generally not available for all of the maximum point source impact points, it is usually impossible to calibrate PSDM. PSDM, therefore, incorporates several elements of conservatism to ensure that errors made in the prediction of pollutant concentrations will tend toward overestimation rather than underestimation. These elements of conservatism include:

1. The point source diffusion model PSDM tends to overestimate pollutant concentrations because the Gaussian plume formula neglects the large contribution of vertical wind shear to the dispersion of the plume. Without resorting to an extended and costly field verification program for each locale it is not possible to assess precisely the extent of overestimation. The model may overestimate by a factor of two or more under some conditions.

2. For the elevated lid cases (Stabilities 5, 6 and 7), PSDM places the inversion lid at the final plume height. This assumption adds further conservatism to the model since the height of the inversion lid is made a function of stack parameters rather than of meteorology, which is clearly unrealistic and leads to an overestimate of the maximum concentration for a station with more than one stack height or plume rise characteristic.

3. The fact that PSDM assumes that stability, wind direction, and wind speed remain constant for a full hour (or three-hours) is often a misrepresentation of the non-constant real world and generally contributes further to high calculated concentrations. In addition, it is assumed in the calculation of the three-hour average concentrations for the inversion lid classes that the lid stays at the worst height for the three hours.

4. Recent literature (Weber, 1970; Stephens and McCaldin, 1971) indicates that SO_2 in the atmosphere is subject to removal processes that may substantially reduce concentrations with time. Estimates of the half-life of SO_2 have been proposed that vary from 30 minutes to 6 hours. Neglecting this decay rate may again lead to overestimation by a factor of two for long-term averages, particularly at receptors more distant from the source.

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APPENDIX E

ANALYSIS OF INTERACTIONS BETWEEN BUILDING WAKES AND THE STACK PLUME OF THE MEDICAL AREA TOTAL ENERGY PLANT

APPENDIX E

Analysis of Interactions Between Building Wakes and the Stack Plume of the Proposed Masco-Harvard Power Plant

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Figures

1. INTRODUCTION

The purpose of this analysis is to determine by calculation (a) whether existing tall buildings near the proposed Masco-Harvard power plant will introduce sufficient disturbance into the atmospheric wind to require modifications of the dispersion models that are conventionally used for isolated stacks, and (b) the maximum concentration to be expected at the surfaces of these buildings due to the power plant plume.

2. BASIC DATA

Power plant data was provided in correspondence from P. L. Geiringer dated January 17, 1975.

	Present		Future
	Max. load	Min. load	Max. load
Oil Rate (lb/hr)	6.798×10^4	2.584×10^4	10.034×10^4
Effluent			
Mass flow (lb/hr	1.060×10^6	0.467×10^6	1.527×10^6
Temperature (°F)	375	375	375
Exit velocity (ft/sec)	60	60	60
Actual volume flow (ft^3/sec)	6,170	2,740	8,920
Stack			
Exit diameter (ft)	11.45	7.63	13.80
Height above local grade (ft)	300	300	300

Building dimensions and topography were taken from the following drawings:

BTA Masco 7407 dated December 19, 1974 (no title - site plan)

BTA Masco 7407 no date, site plan.

Harvard U. Planning Office, Figure 4, Roof Elevation of Principal Area Buildings.

BGA Job No. 437 Sheet 3, AHC, Site Development Plan, February 14, 1975.

BGA Job No. 437 Sheet 4, AHC, Plaza Site Plan, February 14, 1975.

BGA Job No. 437 Sheet 17, AHC, Building Section, February 14, 1975.

Figure 1 shows the four buildings which are tall enough to be considered in this analysis. They are identified below:

No.	Name	Roof Elevation (ft)	Roof Height[1] above stack grade (ft)	Direction[2] from stack (deg)	Distance[3] from stack (ft)
1	Dana (CCRF)	215	180	032	410
2	Apt. (CHMC)	274	239	017	625
4	Childrens Res.	275	240	049	675
5	AHC	244	209	098	285

Notes: (1) Stack grade assumed 35 ft.

(2) 000=north

(3) Measured to intersection of direction line with nearest wall

3. CALCULATIONS

The plan of the calculation is (a) to estimate the plume configuration for various wind speed - stability combinations with no building wake effect, (b) to estimate the building wake properties, and (c) to superpose (a) and (b) and determine the extent of the interaction.

3.1 PLUME CONFIGURATIONS

Figure 2 shows plume configurations for present maximum load for wind speeds of 5, 10, 20, and 50 mph at stack top elevations. Associated with each wind speed is a stability class that produces the lowest plume boundary by virtue of maximum plume expansion, yet is compatible with the magnitude of the speed. Thus, only neutral stability D is possible at 50 mph, but gradually weakening stability is permitted as the speed is lowered. This arrangement maximizes the possibility of plume interaction with the buildings.

Plume centerline trajectories were calculated according to the Briggs (1969) equation

$$\Delta H = 1.6 F^{1/3} x^{2/3} u^{-1} \qquad (1)$$

$F = g Vo Ro^2 (1 - T/To) = 23.1 \times 10^3 ft^4 sec^{-3}$

$g = 32.2$ ft sec^{-2}

Vo = emission velocity = 60 ft sec^{-1}

Ro = emission values = 5.73 ft

T = ambient temperature = 70F

To = emission temperature = 375 F

x = downwind distance (ft)

u = wind speed (ft sec^{-1})

Briggs asserts that Eq(1) is valid for $x \leq x^*$

where

$$x^* = 0.52 F^{2/5} h_s^{3/5} = 885 \text{ ft.} \qquad (2)$$

$h_s = 300$ ft.

This is the range of distances in the present application.

The plume boundaries in Fig. 2 are the 2.5 σ_z distances measured normal to the plume centerline, computed according to the Halitsky (1966) method for the jet region, with subsequent expansion at longer distances according to Turner (1970) Fig. 3-2 and Fig. 3-3. Halitsky's method specifies the initial growth of the jet plume radius from Ro at the stack to R_2 at a distance S_2 measured along the plume centerline from the stack to the end of the jet. R_2 and S_2 are given in Halitsky's Fig. 10 as functions of velocity ratio (emission speed/wind speed) and R_o. Then $\sigma_z = R_2/2.5 + \Delta\sigma_z$ with $\Delta\sigma_z$ obtained from Turner's Fig. 3-3. using $S-S_2$ as abscissa.

Figure 3 is similar to Fig. 2, but at present minimum load. Two options are shown. The upper figure represents reduction in emission velocity at constant diameter. The lower figure shows the effect of a nozzle to maintain the emission velocity at 60 ft. sec.$^{-1}$.

3.2 WAKE CONFIGURATIONS

Fig. 4, 5 and 6 the wake configurations of Bldgs. 5, 1 and 4 respectively. The shapes of the wake and cavity boundaries were calculated from Section 5-5 by Halitsky in Slade (1968). Basically, the wake boundry is given by Eq (5.67) as

$$Rw = L\ (X/L)^{1/4} \qquad (3)$$

where

Rw = wake radius (ft)

X = distance downwind from flow separation point (ft)

L = characteristic cross-wind dimension of building (ft)

Eq (3) was derived from experimental data on flat plates suspended in a

low turbulence wind tunnel. The dimension L is equal to the square root of the plate area.

In applying Eq (3) to a 3-dimensional building resting on the ground in a high turbulence wind, some adjustment is necessary, compatible with the wake shapes shown in the smoke photographs of Sec. 5-5. The following procedure was adopted:

1. Length L was taken as the width W of the projection of the building on a plane normal to the wind.
2. The longitudinal centerline of the wake was assumed to be midway between the lateral extremities of the building and W/2 below the roof edge.
3. The wake boundary radius was assumed to be

   $$Rw = 0.5W + 0.5\,BW\,[2(x/W)^{1/4} - 1] \qquad (4)$$

   where B is a shape factor and the origin of Rw is along the wake centerline defined in 2 above. When B=1 and W=L, Eq(4) reduces to Eq (3).

In selecting numerical values for B, reference was made to Fig 1 of this report and Figs. 5.20 and 5.23 of Slade (1968).

For Bldgs. 1 and 2, the wind approached the building perpendicularly, thereby approximating the flat plate condition; therefore B was taken as equal to 1. For Bldg. 4, the building is operated at an angle to the wind, therefore the wake width is reduced, represented by B=0.75. For Bldg. 5, the rounded edges eliminate abrupt separation, leaving a still smaller wake with B=0.5.

The end of the cavity was taken as 2.83L for Bldg. 1 (resembling a flat plate) and 2.5L for Bldgs. 4 and 5 (resembling the reactor shell of Fig 5-23). The cavity contour was estimated by eye.

4. SUPERPOSITION OF PLUME AND WAKE

The plumes of Fig. 2 are superimposed on the wake of Bldg. 5 in Fig. 4. It is seen that the 10 mph-B plume lies wholly above the wake, but the 20C and 50D plumes intersect the top of the wake. The effect of plume intersection with a wake may be evidenced in two ways. First, if the wake turbulence is stronger than atmospheric turbulence in the plume, some of the plume material will be drawn down into the wake. If this material does enter the cavity, re-circulation will bring it to the building walls. Second, the descending flow in the lee of the cavity may cause descent of the plume proper.

In Fig. 4, plume material will not reach the cavity and the streamline curvature at the top of the cavity in the vicinity of the plume is negligible. Therefore, these pose no problems. To estimate how much of the plume material will be drawn toward the ground, we may note that the longitudinal turbulence intensity in the wake at a distance of $X = 3.6L$ has the characteristics shown in the graph at the top of Fig. 4 (from Slade Pg. 225). The intensity increases from 0.11 at the ground to a maximum of 0.22 near the periphery and then decreases to the ambient turbulence level.

Whether or not the wake turbulence will move material downward more rapidly

in the wake than ambient turbulence does in the plume depends upon the magnitudes of the two types of turbulence.

Ambient turbulence intensity may be estimated by using the relationships

$$\sigma u/u \doteq \sigma v = \sigma_\theta \text{ (rad)} \qquad (5)$$

and

$$\sigma w/u = (\sigma v/u)\,[\sigma_z/\sigma_y \quad [= \sigma_\theta \text{ (rad)}\,[\sigma_z/\sigma_y[\qquad (6)$$

The following may be found from Slade Figs. A-2 and A-3

Stability	σ_θ deg	σ_θ (rad)	σ_z/σ_y	$\sigma_w/_u$
B	20	.35	.52	.18
C	15	.26	.54	.14
D	10	.17	.50	.09

The values of $\sigma w/u$ are also shown in the graph at the top of Fig. 4.

If we conservatively assume that wake turbulence isotropic, then wake $\sigma w/u$ = wake $\sigma u/u$, and the wake $\sigma u/u$ and the atmospheric $\sigma w/u$ in the graph can be compared. It is readily seen that the wake turbulence exceeds the atmospheric turbulence in only a small region. Therefore, the wake will have only minimized effect on the plume behavior. Similar conclusions may be drawn from Figs. 5 and 6.

The plume - wake interaction under present minimum load conditions will be

greater, but the basic concentrations in the plume are only half as large as under present maximum load. Therefore, this condition, also, may be disregarded.

The effects dismissed above are purely local, since wake turbulence decays with distance downwind and ambient turbulence governs elsewhere. Therefore, maximum ground level concentrations, which occur several kilometers from the stack, will not be affected by the building wakes.

When the wind direction is opposite to that shown in Figs. 4-6, the stack will stand in the building wake. However, the top of the stack will be only marginally affected.

5. CONCLUSIONS

1. The calculations presented herein indicate that the plume behavior for a 300 ft. stack under the given wind and effluent conditions can be adequately modeled with isolated stack equations for prediction of maximum ground level concentrations.

2. None of the buildings will experience significant contamination by plume impingement.

6. RECOMMENDATIONS

1. A nozzle to maintain the emission velocity at 60 ft. sec.$^{-1}$ is recommended to prevent stack downwash. Alternate solutions may be considered.

2. *Wind tunnel tests to verify the above calculations do not seem warranted.*

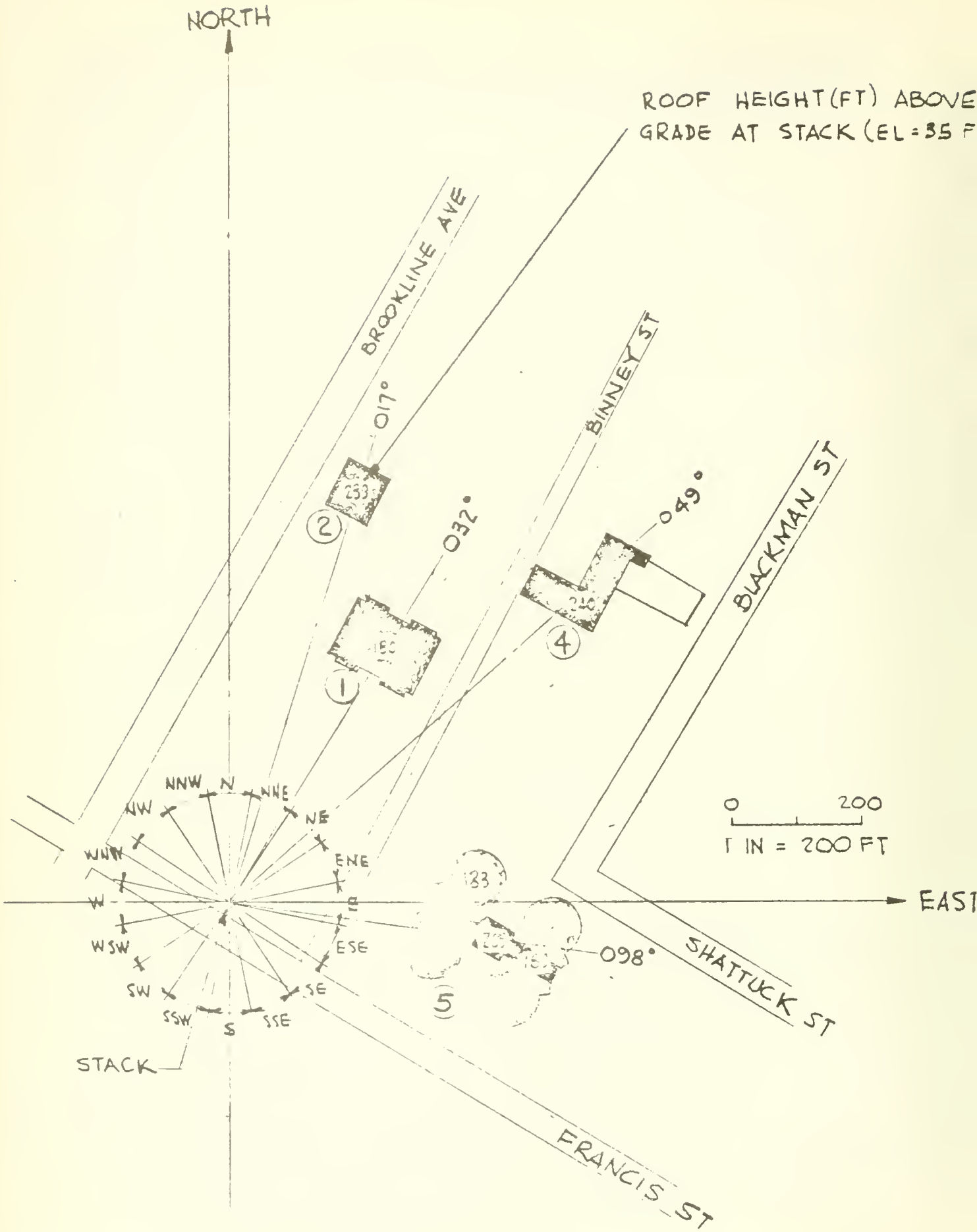

FIG. 1 BUILDING ARRANGEMENT

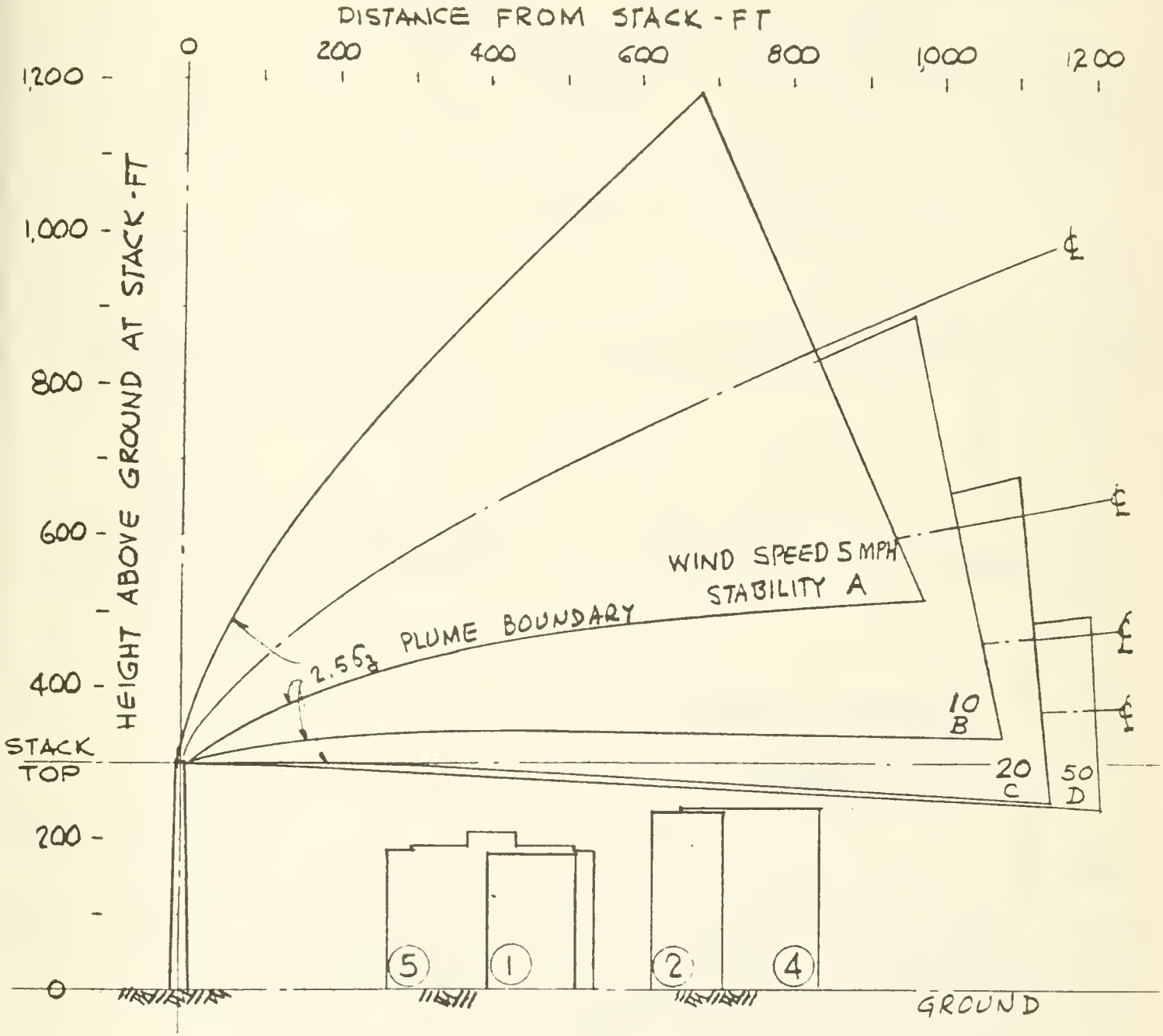

FIG. 2 PLUMES FOR ISOLATED STACK

PRESENT MAXIMUM LOAD

BUILDINGS LOCATED AT CORRECT RADIUS FROM STACK

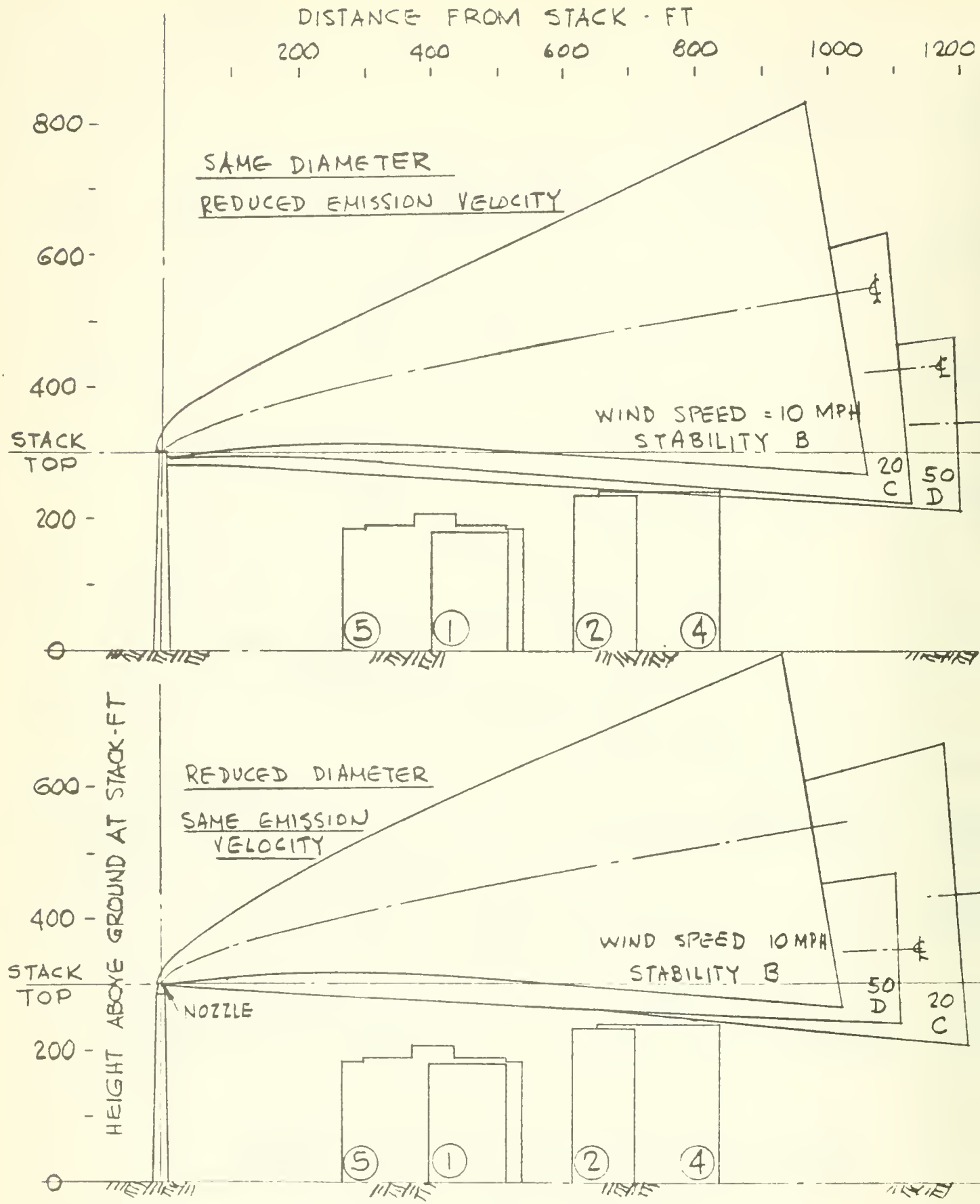

FIG 3 PLUMES FOR ISOLATED STACK

PRESENT MINIMUM LOAD

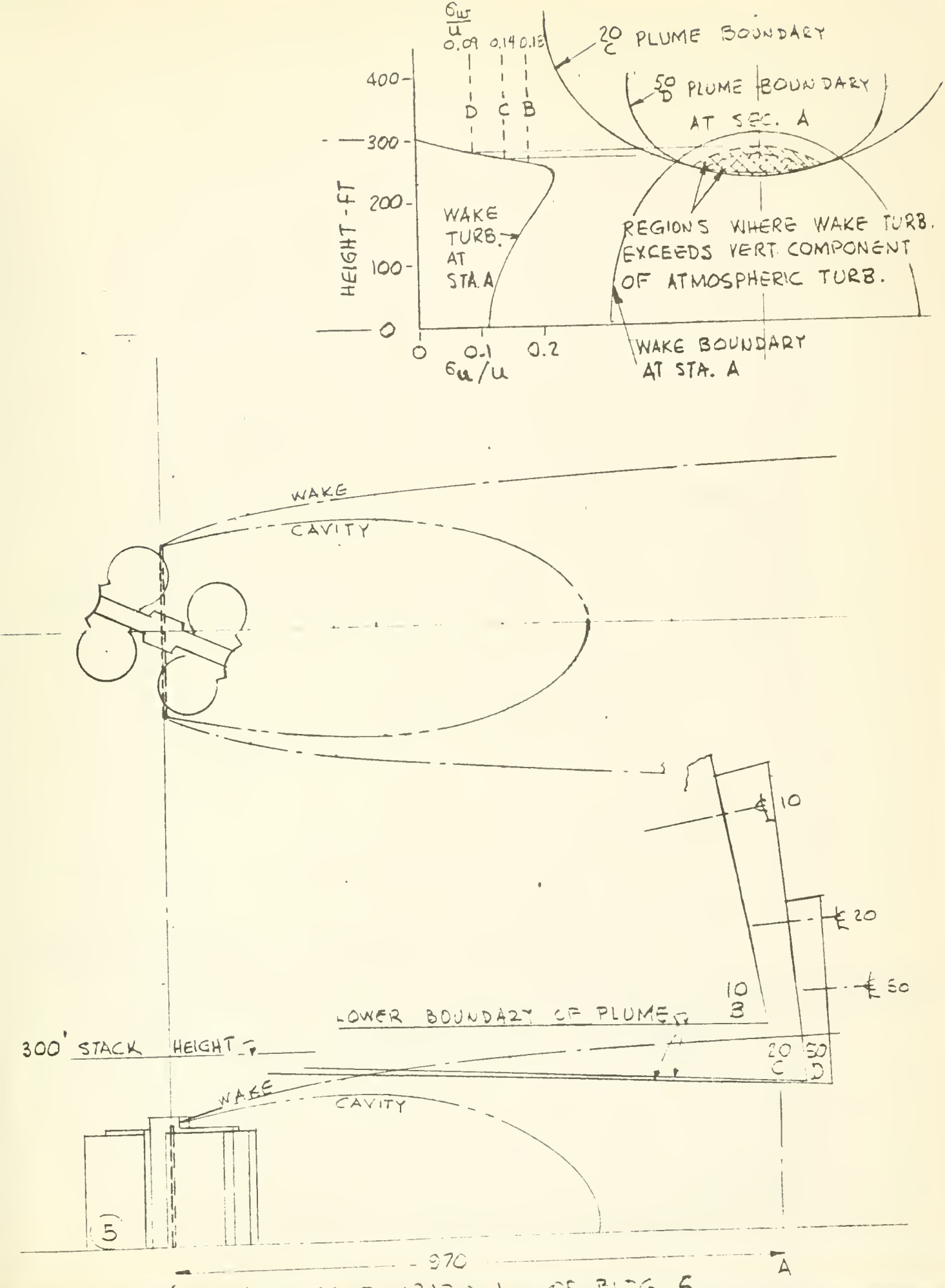

FIG. 4 WAKE CONFIGURATION OF BLDG 5

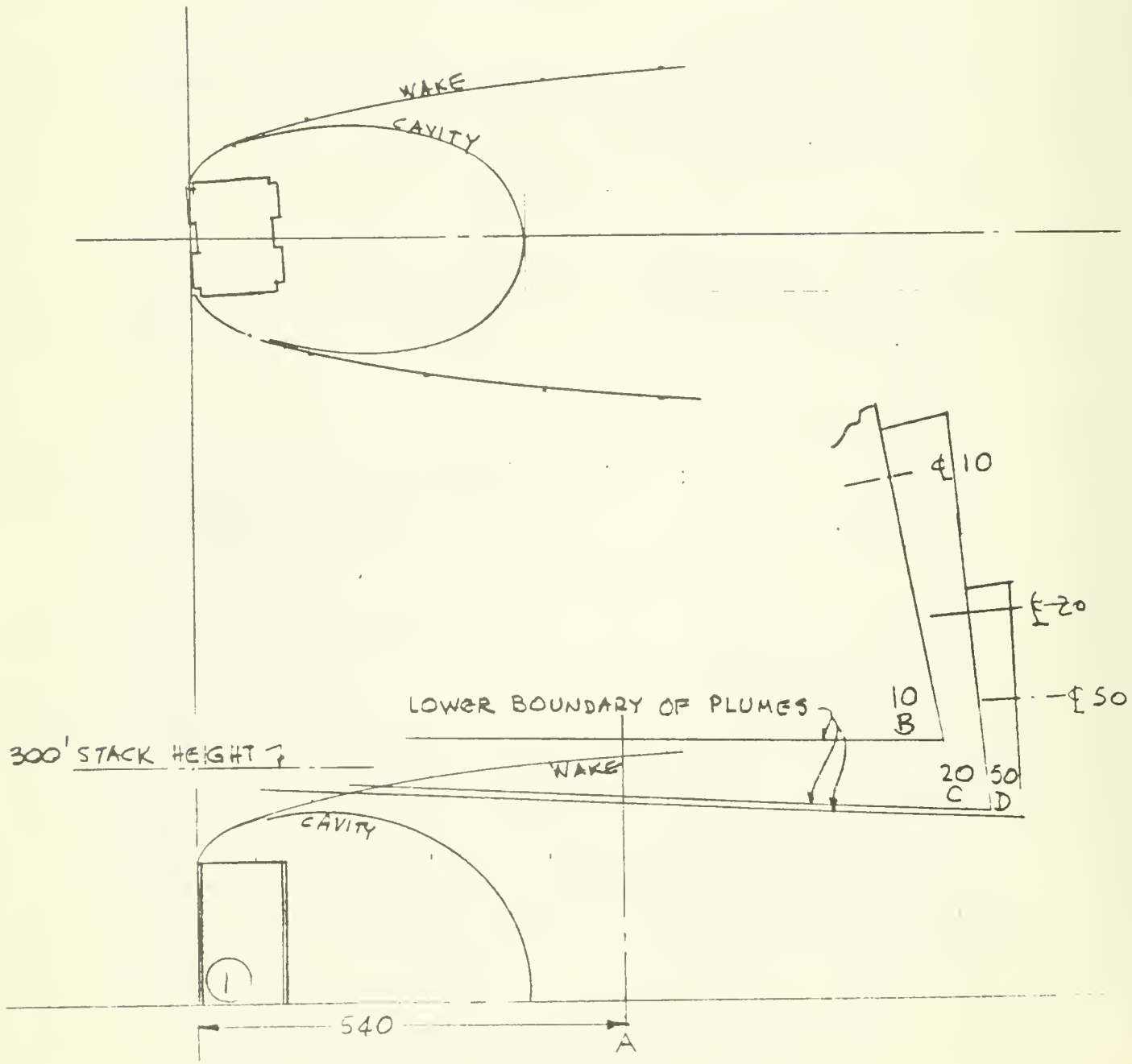

FIG 5. WAKE CONFIGURATION OF BLDG. 1

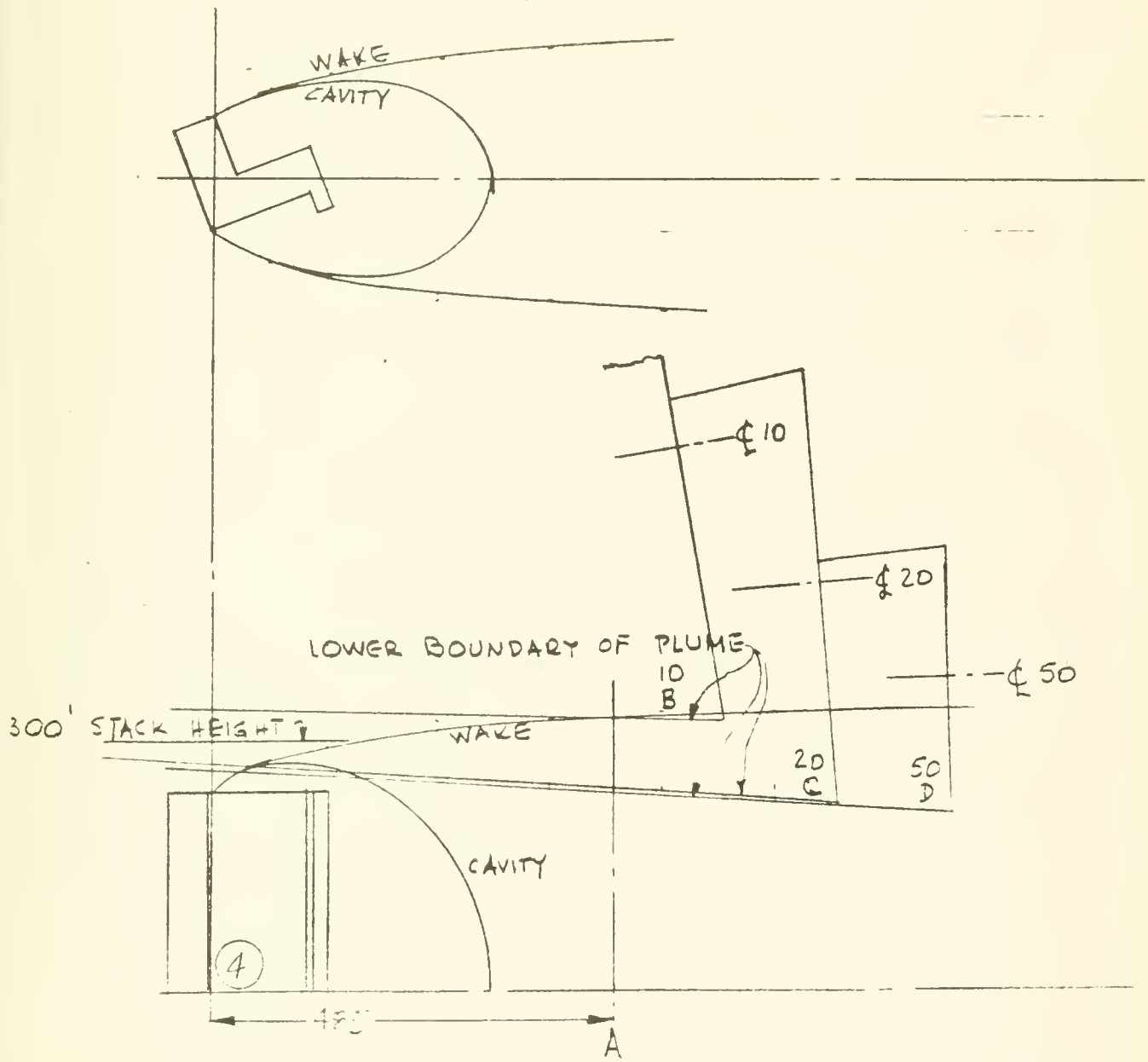

FIG 6. WAKE CONFIGURATION OF BLDG. 4

APPENDIX F
HARVARD UNIVERSITY'S DEVELOPMENT AND LAND USE INTENTIONS

HARVARD UNIVERSITY
GRAYS HALL 16

VICE PRESIDENT
FOR GOVERNMENT
AND COMMUNITY AFFAIRS

CAMBRIDGE, MASSACHUSETTS 02138

April 30, 1974

STATEMENT TO ALL INTERESTED IN HARVARD UNIVERSITY'S DEVELOPMENT AND LAND USE INTENTIONS IN THE MEDICAL SCHOOL, BRIGHAM CIRCLE AREA.

During the past several years Harvard University's representatives have been meeting with interested individuals, community groups, City officials and representatives of other institutions to identify development and land use plans in the vicinity of the Harvard Medical School. As a result of this effort we feel that there has been substantial progress made on a mutually acceptable approach described as follows.

1. Development of Institutional, Academic and Related Service Facilities. These facilities will be constructed in the area to the north and west of a line extending easterly from the Riverway along the southern edge of the block containing the Massachusetts Mental Health center to Vining Street. Along Vining Street in a northerly direction to Francis Street and then easterly on Francis Street to Brigham Circle and then northerly along Huntington Avenue.

Current development proposals planned in this area are:

a. The Affiliated Hospital Center to be constructed in the block bounded by Francis Street on the south and Binney Street on the west. If future expansion of these facilities is necessary, they would look to the land north of Francis Street between Binney Street and Brookline Avenue.

b. The Medical Area Service Corporation total energy plant to be constructed in the area bordered by Brookline Avenue, Francis Street, Fenwood Rd. and the alignment of Binney Street, extended southerly to Fenwood Road. The remaining easterly portion of the block (the area between Francis Street and Fenwood Road and between the alignment of Binney Street and Vining Street plus the existing four vacant lots extending from the corner of Vining Street along Fenwood Road) will be developed for open space and/or recreational use. The plant will be constructed underground with structured parking and probably MASCO office and service space above grade.

c. There are currently discussions within Harvard Medical School relating to plans for a new academic building. Its main occupancy will most likely be research laboratories and it will be located within the institutional development boundaries described above.

2. Residential - The area to the south and east of the line described in (1) bounded by Huntington Avenue, the southerly end of the Convent Site and the Riverway, will remain residential unless there is general community agreement on other types of development.

Current development proposals in this area are:

a. The development entity of RTH, H. R. Taylor and G. Macomber has received a Massachusetts Housing Finance Agency Mortgage commitment to build 858 units of housing (500-low and moderate income units and 358-market rate units) on the thirteen plus acres. This is the site surrounded by the Riverway, Huntington Avenue, St. Alban Road and along the southerly property line of the wood frame houses facing the south side of Fenwood Road from St. Albans Road to Vining Street.

b. Harvard, working with RTH, is about to start an exterior rehabilitation program on most of the remaining wood frame houses. Once this work is underway, a program for the interior rehabilitation of these units will be planned.

3. South of Huntington Avenue - The University has not acquired property east of Hungtington Avenue since the Dean of the Harvard Medical School made a commitment on land acquisition in this area to the community in 1969. (A copy of his statement is attached.) We will continue to abide by this commitment. Although there has been discussion from time to time as to the development possibilities for the land already owned by the University in this area, there are no definite plans or proposals for development. Following is a brief description of Harvard's intentions in this area

a. Quarry Site - Within the next few months we will enter discussions with interested local citizen groups and City agencies to plan for the development of this site. We feel the site can be developed for mixed use, which could include housing, public school facilities, parking, commercial and/or retail space. It would not include any academic, research or similar facilities for Harvard University.

b. Other parcels - The University owns the two vacant lots on Allegheny Street at the corner of Pontiac Street and the building with its land at the intersection of Smith Street, Wigglesworth Street and Huntington Avenue. We have no plans for these properties other than their current use. We are now prepared to discuss proposals by which we could divest ourselves of their ownership. We would like to see these buildings owned, or at least controlled, by present tenants or others interested in owner-occupancy.

4. Planned Development Area. With respect to the long range future, it is our hope and intention to bring the whole institutional area into a Planned Development Area. We intend to work this out with all community, institutional and business interests under the leadership of the City of Boston.

We believe it would be a mistake to now draw any new final lines or reach new understandings in discussion with any one group in the community that might limit the options of others within the community in the forthcoming discussions which will include representatives of all interested groups.

Very truly yours,

Donald C. Moulton

Donald C. Moulton
Assistant Vice President
for Community Affairs

DCM:dd

cc: RTH
Dean Robert Ebert
Hale Champion
Charles Daly

Enclosure:

C O P Y

At a meeting of the

President and Fellows of Harvard College

in Cambridge, December 21, 1970

Voted that the President and Fellows of Harvard College, recognizes an obligation to the Mission Hill-Parker Hill community and the City of Boston to make known its desires and intentions with respect to institutional expansion in order that the stability of patterns of neighborhood living and property values may be encouraged and adequate advance planning for essential municipal services can be implemented.

Consequently, it hereby reaffirms that all current, intermediate, and long-range planning objectives of the Harvard Medical School are based upon and intend a more intensive utilization of land now in institutional ownership and the acquisition of no additional real estate south of Huntington Avenue in the Mission Hill-Parker Hill area of the City of Boston, as long as necessary zoning and other municipal authorizations permit such utilization of land, consistent with sound planning concepts.

A true copy of record,

(signed) Sargent Kennedy

Secretary

APPENDIX G

MEMORANDUM OF UNDERSTANDING

By and Between

ROXBURY TENANTS OF HARVARD

ASSOCIATION, INC.

and

PRESIDENT AND FELLOWS OF

HARVARD COLLEGE

MEMORANDUM OF UNDERSTANDING

By and Between

ROXBURY TENANTS OF HARVARD ASSOCIATION, INC.

and

PRESIDENT AND FELLOWS OF HARVARD COLLEGE

The Roxbury Tenants of Harvard Association, Inc. ("RTH") is a non-profit membership corporation organized and operated under Chapter 180 of the General Laws of the Commonwealth of Massachusetts for the purpose of combating community deterioration and securing adequate housing, community facilities and other related facilities in the geographic area of Boston defined in its By-Laws (the "Community"), a copy of which is attached hereto as Exhibit A. The President and Fellows of Harvard College ("Harvard") is an educational institution existing under the constitution and laws of the Commonwealth of Massachusetts that directly through the Medical School and indirectly as representative of a number of hospitals and other affiliated institutions has an interest in the sound and orderly development of the same geographic area of Boston served by RTH. For a number of years Harvard has conferred with RTH in its capacity as representative of residents of the Community and in its capacity as a partner of the development organization known as Mission Park Associates with respect to various alternative land use proposals in the Community that would result in a

satisfactory accomodation of the needs and desires of both the residents of that area and the institutions located in that area. This memorandum sets forth the agreement arrived at between Harvard and RTH with respect to the appropriate development of certain segments of the Community for use as a mixed-income housing project, total energy plant, materials handling center, parking garage, neighborhood park, and other institutional and residential uses. In addition, since the economic feasibility of the proposed housing project requires certain financial and operating obligations on the part of both Harvard and RTH, this memorandum seeks to outline a basic understanding between Harvard and RTH concerning the long range relationship of each to the other and the entities that will own and finance the housing project for the anticipated 50 year life of such project.

This memorandum does not represent an agreement between RTH and Harvard with respect to the appropriate land use for any segment of the Community not specifically identified herein. Harvard and RTH agree that they have common interests throughout the Community and will continue to confer and cooperate with respect to the appropriate maintenance and use of those segments of the Community that are not covered by this Memorandum; provided nothing herein shall be taken to imply any specific financial commitment by Harvard.

I. General Land Use Agreement

Harvard agrees that the construction of a multifamily mixed-income housing project and related parking garage of the general scope identified in the Massachusetts Housing Finance Agency ("MHFA") mortgage loan commitment dated January 4, 1975 (the "Project") is the appropriate use of that segment of the Community to which the commitment relates for the term of 50 years from the date hereof. It also agrees that the recreational facilities and community meeting areas contained in the project shall be available for use of all members of the Community. Subject to the conditions outlined below (See, Conditions to Harvard Participation) Harvard agrees to participate actively in the financing, construction, and operation of that Project in the manner described in this memorandum and the related memoranda described herein.

RTH agrees that the construction of an aboveground total energy plant of the general configuration described in Exhibit B hereto is the appropriate use of the city block bounded by Francis, Brookline, Peabody and Binney Streets. Subject to the conditions set forth below (See, Conditions to RTH Participation) RTH agrees to support publicly the construction of the total energy plant by, among other things, using its best efforts to inform residents of the Community and other interested civic and governmental groups of the financial interdependence of

the Project and the total energy plant and by advising such groups of its support for the institutional use of the site for a total energy plant as consistent with the long-range development program being undertaken in the Community.

Harvard recognizes that RTH has a direct interest in the reuse of that portion of the block bounded by Francis Street, Vining Street, Fenwood Road and Brookline Avenue that lies on the southeast side of a line extending from Binney Street across such block, and will seek a mutual agreement with RTH with respect to proposals for the use of such block, provided such proposals do not involve the imposition of any costs in excess of $90,000 or otherwise conflict with applicable instructions of MHFA, BRA or other regulatory authorities. In the event an agreement cannot be reached on alternative uses, the retention of six houses and the construction of a community park shall be considered an acceptable use provided the only cost or loss to Harvard is the projected $90,000 cost of the park.

RTH and Harvard further agree that construction of the housing project meets the longstanding need for a single major relocation resource within the Community and frees the northwesterly portion of the block bounded by Francis, Brookline, Fenwood and Vining Streets not referred to in the preceding paragraph for institutional use, and agree to support the

construction of a Medical Area Service Corporation ("MASCO") building to house a materials handling center, parking garage, offices, and other suitable MASCO activities once all tenants in the block have been offered the opportunity to move directly into satisfactory units in the Project or elsewhere under the rent bridge agreement attached as Exhibit C. RTH undertakes to confer with affected tenants and inform Harvard within 12 months after the construction begins which tenants desire to move into the Project and the type of units desired and shall undertake to secure the agreement of such tenants to move directly into the Project upon the availability of such units but no later than substantial completion of the Project.

II. Development Agreement

Harvard agrees with RTH, both directly and in RTH's capacity as a member of Mission Park Associates, that RTH shall have the right to approve the following items of the Program of Development:

A. The number of housing units and the type thereof;

B. The ratio of apartments containing one or more rooms, hereinafter referred to as the "unit mix", and the size and layout of such apartments;

C. The subsidy financing programs to be used, the number of units to be so subsidized and the initial projected rentals for each housing unit;

including the number of 3 and 4 bedroom units under Section 236

D. The preliminary site plan;

E. Preliminary elevations and outline specifications;

F. The basic exterior materials;

G. The building systems to be used; and

H. The Tenant Selection Plan, Affirmative Marketing Plan, the Management Plan, the Management Contract and the form of Tenant Lease to be approved by MHFA.

Each of the foregoing aspects of the Program of Development will be reviewed by RTH with the other members of Mission Park Associates prior to the closing of the MHFA construction loan and each aspect of the Program of Development will be deemed to have been approved by RTH unless it makes its objections known to Harvard prior to such closing. Subsequent to the closing no material change can be made in any approved item of the Program of Development within the control of Harvard without the express consent of RTH; provided, however, that RTH shall not withhold its consent to any changes necessitated by unanticipated circumstances which have a material adverse effect on the financial stability of the Project. In the event of a dispute concerning the materiality of any proposed change to the financial stability of the Project the views of the participants shall be presented to MHFA and its decision shall be final.

III. Management Agreement

Harvard agrees that RTH shall be a co-manager of the Project with the rights and obligations set forth below and shall cause the owner of the Project (the "121A Corporation") to execute a management contract with RTH which contract shall, prior to the maturity of the MHFA mortgage, be terminable only by MHFA. In addition, Harvard further agrees that subsequent to the repayment of the MHFA mortgage, and provided Harvard has the general operating responsibility for the Project, either as owner of a majority of the stock of the 121A Corporation or under the terms of any agreement between Harvard and the owner of a majority of the stock of the 121A Corporation, it will not terminate the co-management agreement.

Under the terms of the co-management agreement RTH shall have the right to participate in causing certain aspects of the management of the Project to be conducted as follows:

A. The initial management agent shall be Hunneman & Co., Inc.

B. A successor management agent or substitute management agent shall not be selected without the concurrence of RTH.

C. Harvard shall be responsible for the supervisory management of the Project and shall have the right at its sole option to terminate the management contract with the managing agent if required under the provisions of the documents providing for the equity financing of the Project, or if in its judgment

the quality of Project maintenance or management is unsatisfactory. Failure to earn the approved return shall constitute unsatisfactory management. RTH shall have the right to approve any successor management agent. In the event of a disagreement concerning a new managing agent MHFA shall be requested to appoint a new managing agent.

D. RTH shall have the right to observe the activities of the management agent and to obtain information from the 121A Corporation, and Harvard and the management agent at reasonable times concerning the activities comprising the management of the Project.

E. If RTH shall conclude that the management of the Project is unsatisfactory, it shall so advise Harvard and the managing agent in writing, and shall set forth in such notice its specific complaints. If, thirty (30) days after such notice has been served, the problems have not been resolved to the satisfaction of RTH, it may request that the management contract be terminated and a new management agent selected.

If, during such thirty (30) day period, Harvard and RTH disagree concerning the complaints made by RTH, either party may submit the matter to arbitration and agree to MHFA as arbitrator. The management agent shall have a right to appear before MHFA and be heard with respect to the issues presented. The

decision of MHFA shall be binding upon Harvard and RTH. If the management agent shall fail to comply with an award of MHFA within thirty (30) days Harvard shall terminate the management contract.

If there is no disagreement among Harvard and RTH, Harvard shall request the management agent to correct the complaints. If at the end of such 30-day period the complaints have not been corrected and RTH requests that the management contract be terminated, Harvard shall determine whether or not such failure is within the control of the management agent and shall take such action as may in its judgment be appropriate, including, without limitation, but subject to MHFA approval, termination of the management contract. Any disagreement between RTH and Harvard concerning the appropriate action to be taken under the circumstances may be submitted to MHFA as provided above.

The co-management agreement between the 121A Corporation and RTH will specifically provide that the objective of satisfactory management is to achieve at least a breakeven financial position for the Project throughout its financial history with a fully adequate maintenance policy. RTH will have a full access to all financial records of 121A Corporation (other than those containing confidential information with respect to particular tenants) including, but not limited to, bills paid and unpaid,

rent rolls, contracts, and financial statements. RTH shall have no obligation to approve or right to disapprove of specific expenditures; however, in conformity with the breakeven philosophy, RTH shall undertake to inform tenants of the need for rent increases to recoup the cost of such expenditures as it agrees are necessary to provide adequate maintenance and service for the tenants.

It is further agreed that so long as Harvard shall have the right to designate members of the Board of Directors of the 121A Corporation, either as a consequence of Harvard's stock ownership or under the terms of any agreement with the majority shareholder it shall designate as one director a person nominated by RTH.

IV. Financial Arrangements

~~RTH shall be paid~~ $50,000 at the initial loan closing (less such sums as have been advanced by Harvard prior to closing) and during the construction period in accordance with the schedule attached as Exhibit D. This payment shall cover the salary of RTH's staff, office expenses, and accounting and legal fees. Commencing thirty months after the initial loan closing, RTH shall be paid by the 121A Corporation at the rate of $15,000 per year in each of the next five years for its services in tenant orientation and training, tenant counseling and/or related matters to the extent RTH's share of any distribution from Mission

RTH and those persons designated in Schedule A hereto shall be paid as

Park Associates is inadequate to yield $15,000 per annum during such period. Following such five year period, RTH and the 121A Corporation shall negotiate an appropriate level of compensation for the services rendered by RTH to the 121A Corporation.

So long as Citicorp is a stockholder in the 121A Corporation, RTH shall receive one-half of all cash flow distributions paid to Harvard with respect to its stock by the 121A Corporation, such payments to commence after reimbursement of Harvard's advances to support unfunded construction costs, guaranteed Citicorp dividends and prior project operating costs. Should Harvard purchase the interest of Citicorp in the 121A Corporation, RTH shall be offered a twenty percent equity interest in the 121A Corporation for a purchase price consisting of (A) $1.00 and (B) an amount equal to twenty percent of the amount paid by Harvard to Citicorp to purchase Citicorp's interest. The portion of the purchase price described in (B) above shall be paid in installments subsequent to the purchase of RTH's interest in amounts equal to the distributions made from time to time to it in respect of its stock interest in the 121A Corporation until the purchase price is paid in full.

The co-management contract and any related agreements between RTH and Harvard or the 121A Corporation shall provide that RTH will make no change in the provisions of its Articles of

Organization or By-Laws with respect to the geographic and financial eligibility for voting membership in RTH and that all financial and participatory benefits derived by RTH under such agreements shall be used exclusively for the benefit of the Project or related purposes consistent with the RTH Articles of Organization.

V. Tenant Selection

The following priorities, subject to the approval of MHFA, the United States Department of Housing and Urban Development and other regulatory agencies having jurisdiction, shall govern the initial rent-up of the housing units included in the Project:

A. Section 236 Subsidized Housing Units.

(1) Eligible families and individuals resident in the RTH Area at the time, or who were residents of the RTH Area at any time prior to initial occupancy of the Project, shall have first priority for the occupancy of 350 of the 500 Section 236 subsidized housing units and second priority for the occupancy of 150 of the 500 Section 236 subsidized housing units as to which the institutions have been given first priority.

(2) Eligible families and individuals who are resident in the Mission Hill Area as of the date of initial occupancy of the Project shall have second priority for the occupancy of such 350 Section 236 subsidized housing units and

third priority for occupancy of such 150 Section 236 subsidized housing units as to which the institutions have been given first priority.

(3) Eligible families and individuals associated with the following organizations shall have first priority for the occupancy of 150 of the 500 Section 236 subsidized housing units: Harvard Medical School; Harvard School of Public Health; the Harvard School of Dental Medicine, Affiliated Hospital Center; Children's Hospital Medical Center; Beth Israel Hospital; New England Deaconess Hospital; Sidney Farber Cancer Center: Massachusetts College of Pharmacy; and Joslin Diabeties Foundation; and their respective successor entities and successor additional members of MASCO.

B. Housing Units with No Section 236 Subsidy

(1) Eligible families and individuals resident in the RTH Area at the time or who were residents of the RTH Area at any time prior to initial occupancy of the Project, shall have first priority for the occupancy of 130 of the 280 unsubsidized units and eligible families and individuals associated with the organizations referred to in paragraph A(3) above, shall have first priority for the occupancy of 150 of the 280 unsubsidized housing units.

(2) Eligible families and individuals resident in the RTH Area at the time or who were residents of the RTH Area at

any time prior to initial occupancy of the Project shall have second priority for the occupancy of the 150 unsubsidized housing units as to which the families and individuals associated with the organizations referred to in paragraph A(3) above have first priority; and eligible families and individuals associated with such organizations shall have second priority for the occupancy of the 130 unsubsidized housing units as to which such families and individuals resident in the RTH Area have first priority.

(3) Eligible families and individuals resident in the Mission Hill Area as of the date of initial occupancy of the Project shall have third priority for occupancy of all of such 280 above referred to unsubsidized housing units.

The parties hereto have not attempted to establish continuing priorities for occupancy of the Project. The parties agree, however, that to the extent allowed by MHFA, continuing tenant selection shall be made with a view toward the Project being a balanced community, representative of the RTH and Mission Hill Areas and the organizations listed in paragraph A(3) above.

All of the foregoing priorities shall be included in the Tenant Selection Plan for the Project, which must be approved by MHFA. RTH shall be responsible for advising its members and persons in the Mission Hill Area of apartment availability prior to publication of advertisements for occupancy. Harvard shall be responsible for advising the institutions of their priorities during this period.

Attached hereto as Exhibit E are descriptions of the RTH and Mission Hill Areas.

Rent bridge subsidies will not be available for market unit tenancy.

In addition, to the extent the 130 market units referred to in B(2) above are not rented within six months of being placed on the market, they may be made available for state leasing subsidies in accordance with the Memorandum of Understanding with MHFA.

VI. Conditions to RTH Participation

RTH recognizes that if the Project is to proceed to initial closing substantial additional sums will have to be advanced by Harvard. Accordingly, RTH's agreement to proceed in the manner outlined herein is subject to the conditions that:

A. Harvard is sufficiently satisfied that the conditions to its participation described below are sufficiently likely to occur by initial closing that it continues to fund the RTH staff working on the Project;

B. None of the required agreements between Harvard and any other party in interest in the Project materially impedes the execution of final documents implementing the understandings described herein; and

C. RTH and its counsel are satisfied that the terms of the co-management agreement, and any other agreement between RTH and either Harvard or the 121A Corporation reflect the understandings described herein.

VII. Conditions to Harvard Participation

Harvard's agreement to proceed in the manner outlined herein and its continued participation in the Project are subject to the following conditions:

A. That parallel understandings to those set forth herein are arrived at between Harvard and Mission Park Associates, MASCO, MHFA, Citicorp and the City of Boston with respect to the matters described in Mr. Champion's Memorandum of January 24, 1975, a copy of which has been furnished to RTH, and

B. Harvard and its counsel are satisfied that the final terms of all documents relating to the Project reflect the understandings between Harvard and each of the other participants.

Executed this 7th day of February, 1975.

PRESIDENT AND FELLOWS
OF HARVARD COLLEGE

By Donald D. Moulton

ROXBURY TENANTS OF
HARVARD ASSOCIATION, INC.

By Robert S. Parker, Pres

APPENDIX H

LETTERS

George S. Isenberg
155 Dorset Road
Waban, Massachusetts 02168
617 - 527-3680

Real Estate
Property Management

Appraisals
Finance

November 26, 1974

Mr. David M. Elovitz
Medical Area Service Corporation
398 Brookline Avenue
Boston, Massachusetts 02215

Dear Mr. Elovitz:

I want to report to you on the current state of negociations pertaining to the Portnoy properties at 93-103 Francis Street Boston, Massachusetts.

It appears that the potential purchase price will have to be higher than what we exspected. The Portnoys have made plans to make this building into a Medical-Dental office building. It seems that they have a son that is a Professor at Tufts Dental. He has lined up other Dentists and Doctors and even a developer to bring this plan to fruition.

To date Mr. Portnoy informs me that they have purchased a fairly new passenger elevator that is in a building that is being demolished. He further states, and I have personally seen, that he is in the process of emptying the buildings of tenants. Since most of his tenants appear to be students, it would seem that at the end of the school year around June he should be able to have his buildings pretty free of tenants.

I shall continue my negociations with the Portnoys and let you know of any further developments.

Very truly yours,

George S. Isenberg

GSI/cl

The Commonwealth of Massachusetts
Metropolitan District Commission
20 Somerset Street, Boston 02108

SEWERAGE DIVISION

January 20, 1975

Mr. David W. Bearg
Environmental Research & Technology, Inc.
696 Virginia Road
Concord, Massachusetts 01742

Dear Mr. Bearg:

Concerning your request on the ability of the Metropolitan Sewerage System to accept 300 gpm to 600 gpm discharge from a proposed total energy plant off Brookline Avenue, Roxbury, please be advised that the Metropolitan System has sufficient capacity in its truck lines that serve this area to accept the proposed flow.

As you note in your letter the character of the proposed flow and its acceptability on that basis is a matter for later discussion.

Very truly yours,

A. C. Hayes
Director of Sewerage Division
and Chief Sewerage Engineer

ACH:dlm

The Commonwealth of Massachusetts
Office of the Secretary
State House, Boston 02133

PAUL GUZZI
Secretary of the Commonwealth

Massachusetts Historical Commission
40 Beacon Street
Boston, Massachusetts 02108

21 January 1975

Mr. David Bearg, Research Scientist
Environmental Research and Technology, Inc.
696 Virginia Road
Concord, Massachusetts 01742

Re: ESD-044; Medical Area
Service Corporation (MASCO)
Energy Plant

Dear Mr. Bearg:

After today's review of the plans for the above proposed project, as delineated by Benjamin Thompson Associates, I have the following comments to make.

The present location of the stack would have a visual impact on the Olmsted Park System (listed in the National Register of Historic Places). However, the impact could be lessened if the stack were moved from Francis Street, directly to the rear of the project area on the north east side.

We also suggest the use of an exterior fabric which would minimize the effect.

The architects and project director are to be commended for retaining and rehabilitating the brick row houses on Brookline Avenue.

Thank you for allowing me the opportunity to comment.

Sincerely yours,

Elizabeth R. Amadon

Elizabeth R. Amadon
State Historic Preservation Officer
Executive Director
Massachusetts Historical Commission

ERA:pj

Boston Police

Office of the Commissioner
154 Berkeley Street
Boston, Massachusetts 02116
617-536-6700 Emergency 911

February 21, 1975

David W. Bearg, Research Scientist
Environmental Research & Technology, Inc.
696 Virginia Road
Concord, MA 01742

Dear Sir:

The proposal contained in your letter, regarding the erection of a power plant in the area bounded by Brookline Avenue, Francis, Binney and Peabody Streets, has been duly considered.

The area in question is near the intersection of Brookline Avenue and the Riverway, both major arteries. The general area is congested with parkers of the major hospitals in the area.

Any construction requiring two and one half years in this type of neighborhood is certainly going to require additional police for traffic and parking control.

Under these circumstances, it is impossible to determine future needs of police services in this area.

Sincerely,

Robert J. di Grazia
Police Commissioner

RJdG/cah

APPENDIX I

STEAM AND ELECTRICITY DEMANDS AND CONSUMPTION AND ASSOCIATED EMISSIONS FOR THE YEAR 1990

This appendix has been prepared to clarify the steam and electricity demands and consumption of the institutions that will be served by the total energy plant on which air quality and truck traffic are based. Calculations for annual and peak emissions are also included.

TABLE I-1

STEAM AND ELECTRICITY DEMANDS FOR 1990

	Electricity	Steam 10^3 lb/hr	
	kw	Space Heating	Hot Water and Process
AHC	5,800	80	20
SFCC Dana Bldg	3,400	40	20
Jimmy Fund Bldg	340	10	4
Redstone Lab	120	4	2
Beth Israel	2,700	85	20
Harvard Medical	9,800	130	39
Joslin Diabetes	1,600	26	9
New England Deaconess	1,800	60	16
Mass. College of Pharmacy	1,000	3	1
Mission Park	-	20	10
Children's	4,800	61	29
Total	31,360	519	170
Diversity Factor	.9	.8	.65
Total	28,224	415	111
Distribution Loss and Plant Usage	111%	115.5%	115.5%
Total Energy Generated	31,329	480	128

TABLE I-1 (Continued)

STEAM AND ELECTRICITY DEMANDS FOR 1990

Peak Diversified Demands

Steam 10^3 lb/hr	
Space Heating	480
Process	128
Total	608
Electricity kw	
	31,329
Operation of Water Chilling System	13,250[1]
Total	44,579

[1]Electricity for operation of the water chilling system during the summer. The electricity demand for water chilling in the winter is about 4,670 kw.

TABLE I-2

STEAM AND ELECTRICITY CONSUMPTION FOR 1990

Steam Consumption (10^3 lb/yr)	
Space Heating[1]	1,131,420
Process[2]	428,400
Existing Absorption Air Conditioning	93,000
Total	1,652,820
Plant Usage and Distribution Loss 115.5%	1,909,007
Electricity Consumption (10^3 kwh)	
Annual consumption[3]	166,200
Plant Consumption[4]	20,536
Operation of Water Chilling System[4]	18,000
Total	204,736

[1]Annual consumption for space heating is peak undiversified demand x 2180 full load hours.

[2]Annual consumption for process steam is peak undiversified demand x 2520 full load hours.

[3]Annual consumption for electricity is peak undiversified demand x 5300 full load hours.

[4]Plant consumption and uses for water chilling is based on equipment consumption and expected annual usage.

TABLE I-3

ANNUAL FUEL CONSUMPTION FOR 1990

Annual steam consumption 1,909,007,000 lb/yr

Fuel consumption for steam generation

$$\frac{1{,}909{,}007 \times 10^{3}\ \text{lb/yr}\ (1{,}198\ \text{Btu/lb}^{1} - 118\ \text{Btu/lb}^{2})}{.82^{3}\ \text{boiler efficiency} \times 145{,}000\ \text{Btu/gal}} = 17{,}340{,}000\ \text{gal}$$

Annual electricity consumption	204,736,000 Kwh
electricity generated by back pressure turbine	-24,300,000 Kwh
electricity generated by diesels	180,436,000 Kwh

Fuel consumption for diesels

$$\frac{180{,}436 \times 10^{3}\ \text{Kwh} \times 9{,}470\ \text{Btu/Kwh}^{5}}{145{,}000\ \text{Btu/gal}} = 11{,}784{,}337\ \text{gal}$$

Credit for heat available from heat recovered. This includes heat reclaimed from the diesels minus heat used for plume abatement.

$$\frac{180{,}436 \times 10^{3}\ \text{Kwh} \times 2{,}080^{6}\ \text{Btu/Kwh}}{.82\ \text{boiler efficiency} \times 145{,}000\ \text{Btu/gal}} = (2{,}824{,}280\ \text{gal})$$

$$- \frac{39{,}500 \times 10^{6}\ \text{Btu}^{7}}{.82\ \text{boiler efficiency} \times 145{,}000\ \text{Btu/gal}}$$

Fuel for back pressure turbine

$$\frac{24{,}300 \times 10^{3}\ \text{Kwh} \times 3{,}800^{8}\ \text{Btu/Kwh}}{.82\ \text{boiler efficiency} \times 145{,}000\ \text{Btu/gal}} = 776{,}619\ \text{gal}$$

TABLE I-3 (Continued)

ANNUAL FUEL CONSUMPTION FOR 1990

Total fuel	17,340,000 gal
	11,784,337 gal
	776,619 gal
	29,900,956 gal
Credit for heat recovery	- 2,824,280 gal
	27,076,676 gal
Oil burned in the diesels	11,784,337 gal
Oil burned in the boilers	15,292,339 gal

Notes for fuel consumption:

1 Heat of steam at 185 psig

2 Heat of condensate at 150°F

3 Efficiency of steam boilers have guaranteed efficiencies of up to 88% at full load. The 82% efficiency has been used to give conservatively high results.

4 Estimate of annual generation of electricity by back pressure turbine. Actual use will probably be greater resulting in lower overall fuel use.

5 Heat rate of diesels at full load. Lower loads have better heat rates.

6 Heat recovery rate from operation of diesels.

7 Heat required for plume abatement.

8 Heat rate for back pressure turbine.

No fuel has been included for incineration since the heat recovered from incineration more than offsets the heat obtained from the fuel.

TABLE I-4

ANNUAL EMISSIONS FOR 1990

Fuel used in boilers	15,292,340 gal	
SO_2 [1] @ 0.5%S	=	1,192,800 lbs
Particulates [1] @ 0.05 $lb/10^6$ Btu	=	110,870 lbs
NO_2 [1] @ 0.3 $lb/10^6$ Btu	=	665,215 lbs
Fuel used in diesels	11,784,340 gal	
SO_2 [1] @ 0.5%S	=	919,180 lbs
Particulates [1] @ 0.05 $lb/10^6$ Btu	=	85,440 lbs
NO_2 [2] @ 2.9 $lb/10^6$ Btu	=	4,955,315 lbs
Emissions from incinerator		
SO_2 [3]		12,410 lbs
Particulates [3]		38,470 lbs
NO_2 [3]		9,930 lbs
Total emissions		
SO_2		2,124,390 lbs/yr
Particulates		234,780 lbs/yr
NO_2		5,630,460 lbs/yr

1 Maximum allowable emission rates established by the Massachusetts Emission Standards

2 Based on manufacturer's and EPA's experience.

3 Based on typical emissions from incinerators.

TABLE I-5

PEAK EMISSIONS IN SUMMER 1990

Electrical demand is 44,579 Kw. 4750 Kw could be generated by the back pressure turbine.

Electricity generated in the diesels 39,829 Kw

$$\frac{39{,}829 \text{ Kw} \times 9{,}470 \text{ Btu/Kw}}{145{,}000 \text{ Btu/gal}} = 2{,}601 \text{ gal}$$

Exhaust heat credit

$$\frac{39{,}829 \text{ Kw} \times 2{,}080 \text{ Btu/Kwh}}{.82 \text{ boiler efficiency} \times 145{,}000 \text{ Btu/gal}} = (697 \text{ gal})$$

Fuel burned in the boilers to operate the back pressure turbine

$$\frac{4{,}750 \text{ Kw} \times 3{,}800 \text{ Btu/Kwh}}{.82 \text{ boiler efficiency} \times 145{,}000 \text{ Btu/gal}} = 152 \text{ gal}$$

Steam demand in August 256,000 lb/hr

$$\frac{256{,}000 \text{ lb/hr } (1{,}198 \text{ Btu/lb} - 118 \text{ Btu/lb})}{.82 \text{ boiler efficiency} \times 145{,}000 \text{ Btu/gal}} = 2{,}325 \text{ gal}$$

4,381 gal

Fuel burned in diesels 2,601 gal

Fuel burned in boiler 1,780 gal (2,325 + 152 -697)

Emissions from diesels and boiler

SO_2 @ 0.5%	=	342 lb/hr
Particulates	=	32 lb/hr
NO_2 - diesels at 2.9 lb/10^6 Btu	=	1,093 lb/hr
boiler at .3 lb/10^6 Btu	=	77 lb/hr
		1,170 lb/hr

TABLE I-5 (Continued)

PEAK EMISSIONS IN SUMMER 1990

Emissions from incinerator

SO_2	2 lb/hr
Particulates	6.2 lb/hr
NO_2	1.6 lb/hr

Total emissions during summer

SO_2	344 lb/hr
Particulates	38 lb/hr
NO_2	1,172 lb/hr

TABLE I-6

PEAK EMISSIONS IN WINTER 1990

Electrical demand 36,000 Kw. 10,300 Kw could be generated by the back pressure turbine.

Electricity generated in the diesels 25,700 Kw

$$\frac{25{,}700 \text{ Kw} \times 9{,}470 \text{ Btu/Kw}}{145{,}000 \text{ Btu/gal}} = 1{,}678 \text{ gal}$$

Credit for heat available from heat recovered. This includes heat reclaimed from the diesels minus heat used for plume abatement.

$$\frac{25{,}700 \text{ Kw} \times 2{,}080 \text{ Btu/Kwh}}{.82 \times 145{,}000} - \frac{39 \times 10^6 \text{ Btu}}{.82 \times 145{,}000} = (122 \text{ gal})$$

Fuel burned in the boilers to operate the turbine

$$\frac{10{,}300 \text{ Kw} \times 3{,}800 \text{ Btu/Kwh}}{.82 \times 145{,}000 \text{ Btu/gal}} = 329 \text{ gal}$$

Steam demand in January 608,000 lb/hr

$$\frac{608{,}000 \ (1{,}198 - 118)}{.82 \times 145{,}000 \text{ Btu/gal}} = 5{,}523 \text{ gal}$$

7,408 gal

Fuel burned in diesels 1,678 gal

Fuel burned in boilers 5,730 gal (5,523 + 329 - 122)

Emissions from diesels and boiler

SO_2 @ 0.5%	=	578 lb/hr
Particulates @ 0.05 lb/10^6 Btu	=	54 lb/hr
NO_2 - diesels at 2.9 lb/10^6 Btu	=	706 lb/hr
boiler at 0.3 lb/10^6 Btu	=	250 lb/hr
		956 lb/hr

TABLE I-6 (Continued)

PEAK EMISSIONS IN WINTER 1990

Emissions from incinerator

SO_2	2 lb/hr
Particulates	6.2 lb/hr
NO_2	1.6 lb/hr

Total peak emissions during winter

SO_2	580 lb/hr
Particulates	60 lb/hr
NO_2	958 lb/hr

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